Private information acquisition by underwriters

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Abstract

This study examines the impact of underwriters' access to private information on IPO pricing, focusing on a unique merger event between a commercial and an investment bank in Japan. Our paper uses the Japanese IPO data because of the important role of the underwriter during the process of setting the offering price. This paper highlights the event that a commercial bank merged with a securities company, which increased the private information of the securities company. Key findings include a significant reduction in the IPO price filing range and a higher probability of the final offer price being set within this range post-merger. These results suggest that underwriters' access to private information, particularly through prior lending relationships, enhances their ability to manage information asymmetry and accurately determine IPO prices. The analysis shows that this effect is pronounced in firms with higher information asymmetry, especially those with significant R&D investments. The paper concludes that mergers enabling information sharing between commercial and investment banks can benefit both issuers and investors by improving IPO outcomes.

1 Introduction

Underwriters play a critical role during the equity issuance process, including minimizing asymmetric information between issuers and investors by acquiring private information (Booth and Smith (1986)). In this process, the acquisition of private information is critical to delivering the signal to investors from issuers. The role of mitigating asymmetric information is especially important during the IPO process due to the lack of a track record of issuers.

Previous IPO research has examined the role of underwriters' information production by focusing on underpricing; however, the results do not support the theoretical prediction. Some studies find supportive results (Carter and Manaster (1990)), while subsequent findings do not support them (Allen and Faulhaber (1989); Beatty and Welch (1996); Loughran and Ritter (2001)). Inconclusive findings would come from the fact that various factors affect underpricing, including investor sentiment, market conditions, and others (Loughran and Ritter, 2004; Liu and Ritter, 2010).[1] Therefore, additional findings without underpricing are required to analyze the role of information production by underwriters in the IPO process.

We exploit the information production by underwriters using the Japanese IPO data for two reasons. First, using Japanese data enables us to examine the unique event of the merger between investment and commercial banks in Japan. In 2012, SMBC, one of the largest commercial banks, acquired Nikko Securities, one of the three largest investment banks in Japan. The merger enabled the investment bank to utilize the private information owned by the commercial bank. Commercial banks usually obtain private information through the lending relationship (**?**). Such private information, obtained *via* lending (Schenone (2004); Drucker and Puri (2005)) and investment by their subsidiary venture capitals (Hellmann, Lindsey, and Puri (2008)), is useful for investment banking companies, including the underwriting of new issue securities (Puri, 1999) and bonds (Yasuda, 2005). Therefore, the merger enabled

[1]Several studies have pointed out that underwriters intentionally occur underpricing to increase their profit.

the merged underwriter to utilize the private information that the commercial bank had for its bookbuilding process.

The second reason for focusing on Japan comes from its unique institutional setting, which enables us to use the filing range in the bookbuilding process as the proxy of the private information of the underwriters. This paper focuses on the price filing range in the book-building process instead of the underpricing because of the unique features of the Japanese IPO process[2] In Japan, the majority of investors allocated the IPO shares are individual investors, whereas, as the majority of shares are allocated for institutional investors,such a high proportion of individual investors demotivates institutional investors to provide private information. Therefore, the filing range is determined by the opinions of institutional investors who are less likely to be allocated the IPO shares, as well as individual investors who participate in the book-building process and do not participate in determining the filing range. Usually, individual investors are regarded as irrational and have less ability to interpret new information compared with institutional investors. If so, replying to the opinions of individual investors does not necessarily include the information disclosed during the bookbuilding process in the offering price.

Moreover, in Japan, the offering prices are determined within the filling range, unlike in the US, where the underwriters and issuers can determine the offering price outside the range.

such restriction for determining the offering price makes the information production process by the underwriter critical. As explained, the offering price is strictly determined within the price range before bookbuilding in the Japanese IPO process. Hence, an underwriter and an issuer face the trade-off of selecting a price range. On the one hand, they prefer to make the range as wide as possible. The investor demand for IPO shares is determined after fixing the filing range.

As the offering price should be within the range, a low maximum price leads to concern

[2]See Kutsuna and Smith (2004) that explain the details of the Japanese bookbuilding process.

about high underpricing. However, the wide price range is less informative for investors. Kutsuna, Smith, and Smith (2009) argue that "because the range constrains the offer price, it can be costly for an issuer to agree to a maximum price that it perceives to be too low. In contrast, because, unless the issuance is canceled, the underwriter is committed to purchasing the offer from the firm, it can be costly to agree to a minimum that is too high. Because the choice of filing range is not restricted, issuers and underwriters can avoid the potential for the range to limit the offer price by selecting a very broad range."

This paper shows that the private information of the underwriter influences IPO pricing by using the event of a merger between a commercial bank and an investment bank in Japan.

The empirical findings are as follows. First, the study demonstrates that the merger led to a substantial reduction in the price filling range. The estimated coefficients from the empirical models show that IPOs with the merged underwriter exhibited narrower price ranges post-merger, which suggests that the underwriter's access to additional private information from the commercial bank improved the accuracy of IPO pricing. This reduction in the price range indicates a decrease in uncertainty and information asymmetry between issuers and investors.

Second, the paper finds that the probability that the final price of the IPO offering is set within the filling range increased significantly after the merger. This suggests that the merger helped the underwriter set more accurate price ranges, making it more likely that the final offer price would be set within this range rather than at its extremes. The results of this analysis remained robust even after controlling for industry and issuer characteristics.

Additional tests explore the role of lending relationships, revealing that issuers with prior loan contracts with the commercial bank experienced more precise pricing after the merger. This finding highlights the importance of the private information generated from lending relationships in enhancing the underwriter's ability to set appropriate price ranges.

We also test the cross-sectional comparison by adding an interaction term with the measurement of asymmetric information. This finding shows that the impact of the information

generation process by the merged underwriter is pronounced for IPOs with high asymmetric information.

Overall, the merger allowed the investment bank to take advantage of new sources of private information, improving its ability to manage asymmetric information and set more accurate IPO price ranges, which benefits both issuers and investors. These results contribute to the broader understanding of how underwriters' access to private information affects IPO outcomes.

2 Institutional setting

This section explains the background of our study. First, we review the process for determining the offering price in Japan. Next, we report the details of the merger of Nikko with the SMBC holding.

2.1 Bookbuilding process in Japan

Japanese IPOs utilize a book-building method similar to that in the United States. The process unfolds as follows. First, an underwriter discloses the preliminary prospectus. A company aspiring to go public engages a securities firm as its underwriter. They thoroughly analyze the company's financial health, prospects, and current market conditions. This assessment forms the basis for establishing a preliminary stock price, termed the "original price."

Second, First Revised Prospectus. The underwriter presents the estimated issue price to potential major purchasers, primarily institutional investors. During this phase, known as the "roadshow," the underwriter gathers crucial demand data and refines the public offering price range. Post-roadshow, the underwriter establishes upper and lower limits for the public offering price, referred to as the "filing range."

Third, Second revised prospectus. Investors indicate their interest by specifying the

number of shares they would purchase and at what price within the given range. The underwriter uses this demand information to determine the final "offer price."

Forth and the end, First aftermarket closing price. Trading begins on the stock exchange. The first traded price, typically set by the opening auction on the inaugural day, is the "initial price."

The bookbuilding process in Japan is different from that in the US, as shown in Figure1. First, while in the US, underwriters conduct Pre-Hearings for various institutional investors who potentially purchases the IPO shares. The filling range is determined on the basis of the results of Pre-Hearings. Based on the filling range, the underwriters conduct a roadshow for various institutional investors, and then the order book is built. In Japan, the filing range is determined on the basis of the results of the roadshow. The underwriters build an ordering book based on the filling range.

It is worth mentioning two unique aspects of the Japanese bookbuilding process. The first one is the Nature of the filing range. In the U.S., the filing range is flexible. The final offer price may exceed the upper limit if investor demand exceeds initial expectations. In contrast, weak demand can result in a price below the lower limit. Essentially, the filing range is a guideline rather than a strict boundary. In Japan, the filing range is more rigid. Regardless of the strength of the demand, setting the offering price above the upper limit is unconventional. The filing range effectively acts as a binding constraint on the final price.

The second point is the type of investor. In the U.S., the lead underwriter's demand survey and the primary allocation of new shares target institutional investors. Aggarwal (2003) reports that 72.8% of IPO stocks in 1997-1998 were allocated to institutional investors. In Japan, while the post-roadshow demand assessment focuses on institutional investors, most newly issued shares are ultimately purchased by individual investors. Funaoka (2008) shows that 74.1% of the IPO stocks in the 2006-2008 were allocated to individual investors in Japan.

The unique characteristics of the Japanese market lead to an important distinction: in

Japan, the filing range is primarily determined by underwriters and almost entirely reflects the information they produce. As Kaneko (2019) notes, the "original price" and the midpoint of the filing range are positively correlated, with a very high correlation coefficient of 0.991. The opinions of institutional investors are hardly reflected when determining the filing range.

Overall, we can summarize that the filing range is much more important than that in the US IPO process.

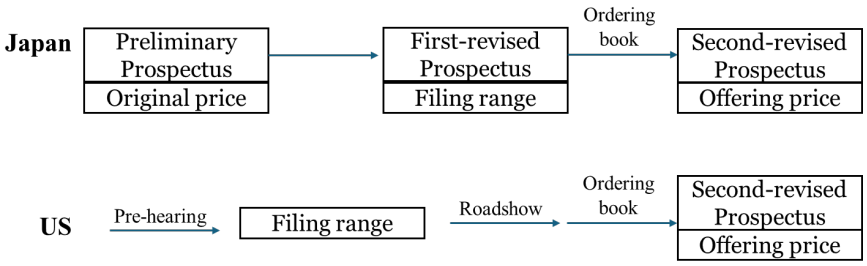

Figure 1: IPO underwriting process in Japan

2.2 Merger event between the commercial bank and securities company

The Securities and Exchange Law of 1947 (Article 65) prohibited commercial banks from engaging in securities-related business. In 1992, the Financial System Reform Act significantly relaxed the regulations separating banking and securities businesses. This allowed for mutual entry between banks and securities firms by establishing sector-specific subsidiaries. Following this reform, banks could share confidential corporate client information between a parent bank and its investment banking subsidiary, provided that they secured prior written consent from the client. This provision was outlined in Article 44-3(1)(iv) of the Financial Instruments and Exchange Act. The 2009 revision to financial regulations further liberalized information sharing practices for banks. Under the new rules, banks can provide the private information of corporate clients with their subsidiaries without obtaining prior written approval unless the client had explicitly designated certain items as confidential. This change

significantly enhanced the information flow between parent banks and their underwriter subsidiaries, potentially streamlining their collaborative operations.

Daiwa Securities SMBC was established in 1999 through the merger of Sumitomo Bank's securities company and the corporate division of Daiwa Securities. According to Nikkei Business (2012), the two entities had different management philosophies after the merger. An executive of Sumitomo Mitsui Banking Corporation expressed frustration: "In 2001, when our bank merged with Sakura Bank (whose predecessors were the former Mitsui Bank and the former Taiyo Kobe Bank), it should have brought significant benefits to Daiwa, as Mitsui-affiliated companies became customers in addition to Sumitomo-affiliated companies. Although the project started to create Japan's top investment bank together, the relationship hasn't progressed." On September 10, 2009, Sumitomo Mitsui Financial Group and Daiwa Securities Group Inc. held separate press conferences to announce the dissolution of their joint venture.

On May 1, 2009, SMBC officially announced that it had agreed to acquire Nikko Cordial Securities from U.S.-based Citigroup. The acquisition amount was set at 545 billion yen. Although it became a wholly owned subsidiary of U.S.-based Citigroup in 2008, the combined assets under management of Nikko Cordial Securities, which focuses on retail customers, and Nikko Citigroup Securities, which serves corporate clients, ranked third in the industry. This marked the first acquisition of a major securities firm by a megabank in the context of financial restructuring amid market turmoil. The acquisition targets include all business operations of Nikko Cordial Securities, which focuses on retail (individual) customers, and the equity and bond underwriting operations of Nikko Citigroup Securities, which serves corporate clients. The acquisition was completed on October 1, 2009. From Table 1, we can observe that after being acquired by SMBC, Nikko consistently maintained its position among the top three in the industry. Moreover, in most years, it replaced Daiwa Securities to occupy the second place in the market.

3 Empirical strategy

4 Methodology

We test whether the merger of an investment and a commercial bank affects the filing range of IPO stocks by estimating:

$$Range_{ijyu} = \alpha + \alpha_u + \alpha_j + \alpha_y + \beta_1 Treat_{ut} \times Post_t + \sum \gamma X_{ijyu} + \epsilon_{jiyu}, \tag{1}$$

where $Range_{ijyu}$ is the price range of IPO firm i in industry j that went public in year y underwritten by underwriter u. $Range_{ijyu}$ is defined as the difference between the maximum and minimum of the price range, divided by the mid-range of the filing range. $Treat$ takes the value of one for the IPOs underwritten by the merged underwriter, Nikko. $Post$ is an indicator for IPOs underwritten after the merger event. Our parameter of interest is γ_1 that is the estimated coefficient of $Treat \times Post$. If the merger with a commercial bank improves the investment bank's private information, we expect a smaller price range after the merger event; hence $\beta_1 < 0$. Furthermore, as the IPOs before and after the merger events are different. Therefore, we control various issuer's characteristics by adding a vector of control variables X.

The type of underwriter can affect the outcome of IPOs in various ways. Therefore, we control underwriter-level characteristics by adding underwriter fixed effects (α_u). Furthermore, it is well argued the cyclical of IPO markets. Therefore, we add year-fixed effects (α_y). We also control industry-level heterogeneity in the IPO market by adding industry-fixed effects (α_j).

Next, we test whether the merger event affect the probability of offering price in the middle of the range by estimating:

$$Within\ Range_{ijyu} = \alpha + \alpha_u + \alpha_j + \alpha_y + \beta_1 Treat_{ut} \times Post_t + \sum \gamma X_{ijyu} + \epsilon_{jiyu}, \tag{2}$$

where $Within\ Range_{ijyu}$ that takes the value of one if the offering price is determined above the minimum and below the maximum of the price range, and zero if the offering price is the same with the maximum or minimum of the heterogeneity of the standard errors clustered at the underwriter level. We estimate Eq. 3 with a linear probability model using OLS estimates.

4.1 Definitions of control variables

The vector X contains that can affect asymmetric information between issuers, underwriters, and investors. First, we add $EBITDA\ ratio$ as the measure of firm profitability. The idea is that if the IPO firm is profitable enough, the risk of future cash flow is low, making it easy for investors to predict future free cash flow. R&D expenditure, $R\&D$, is included because private information scares the issuers with high R&D intensive firms. Secondary shares in IPOs can lead to agency conflict. Therefore, we add a secondary share ratio. Lastly, we also control the firm's financial condition by adding cash ratio and financial leverage.

The definitions of the variables are explained in Section A-1 of the Appendix document.

4.2 Data

We collect the IPO information from INDB's Funding Eye database. The Funding Eye collects detailed information on securities issuance in the Japanese stock market. The dataset covers equity issuance by listed companies in Japanese stock markets. We restrict the records tagged as "IPOs" from Funding Eye.

We collect stock price and accounting information from Nikkei's NEEDS FinancialQUEST service, which is widely used in the analysis targeting Japanese listed companies. The data covers all companies listed on all stock exchanges in Japan.

Table 1 reports the summary statistics of the variables used in this study.

The sample period of this paper is between 2000 and 2022. The lead underwriter is identified using the data from Funding Eye. In the case of global offering, usually domestic

Table 1: Summary Statistics
This table reports the summary statistics of the variables used in this study.

	Mean	Std. Dev	50%Tile	25%Tile	75%Tile
Offer price adjustment	0.05	0.05	0.05	0.03	0.07
Offer price within the filing range	0.07	0.25	0.00	0.00	0.00
Initial return	0.72	1.07	0.35	0.04	1.06
Proceeds	7.39	1.29	7.13	6.53	7.97
Asset size	8.55	1.42	8.37	7.54	9.38
EBITDA ratio	-0.38	15.85	0.11	0.07	0.18
Leverage	0.52	0.22	0.53	0.35	0.70
R&D	0.26	6.54	0.00	0.00	0.01
Cash	0.36	0.23	0.31	0.16	0.52
Secondary share	0.44	0.21	0.44	0.29	0.57
BHR(1 year)	0.03	0.98	-0.20	-0.48	0.22
BHR(2 year)	0.07	1.37	-0.26	-0.59	0.26
BHR(3 year)	0.17	1.86	-0.28	-0.62	0.29
Loan repayment demand	0.29	0.45	0.00	0.00	1.00
Young	0.25	0.44	0.00	0.00	1.00
Small	0.25	0.43	0.00	0.00	1.00
Observations	2037				

and international underwriters co-work. In this case, we regard the domestic bank as the lead underwriter.

Table 2 shows the time-series trend of the underwriter shares by the so-called top-3 securities companies (Nomura, Nikko, and Daiwa).

5 Empirical results

5.1 Determinants of the price range

We begin our analysis by examining the relationship between the bank merger and the price range by estimating Eq. 3.

Table 3 reports the estimated coefficients and the dependent variable is the price range. Column 1 reports the results without industry-fixed effects. The estimated coefficient of our

Table 2: Dynamics of the underwriter market in Japan
This table reports the share of top three securities companies in Japanese IPO underwriting market.

Year	Nikko	Nomura	Daiwa
2000	10.1%	54.5%	25.8%
2001	10.4%	46.2%	32.9%
2002	10.5%	16.1%	40.5%
2004	30.6%	35.8%	21.9%
2005	30%	24.8%	30.4%
2006	5.7%	26.6%	56.9%
2007	16.7%	52.2%	12.3%
2008	3.6%	9.3%	60.1%
2009	-	3.9%	-
2010	-	97.9%	1.5%
2011	8.1%	66.6%	17.8%
2012	4.8%	85.7%	6.2%
2013	13.2%	77.6%	3.8%
2014	5.9%	75.1%	4.6%
2015	54.6%	24.9%	5.3%
2016	3.6%	70.2%	6.8%
2017	29.6%	34.9%	6.2%
2018	22.6%	29.8%	34.3%
2019	19.9%	24.9%	30.3%
2020	10.9%	22.8%	12.7%
2021	34.5%	25.7%	23.9%
2022	20.2%	23.6%	6.8%

variable of interest,$Treat \times Post$, is negative ($p < 0.01$). The negative coefficient indicates that the merged underwriter allowed the filling ranges to narrow after the merger event after controlling various factors.

The control variables show the following finding, which is reasonable. The size of the firm is negatively correlated with the filling range. The negative relation indicates that asymmetric information is one factor that affects the price range if the degree of asymmetric information is negatively correlated with firm size. Firm profitability is also negatively correlated with the filling range. Investors find it difficult to distinguish between low-quality and low-profitable firms and high-growth potential and low-profitable firms. Then the degree of asymmetric information is high for low-profitable firms. The negative correlation between

profitability and filing range is consistent with the prediction. R&D expenditure is negatively correlated with the filling range. R&D intensive firms face high asymmetric information due to their technology-driven business model. Our findings show that these firms have a narrow filing range.

Next, column 2 adds industry-fixed effects in order to control for the industry-level heterogeneity. The bank merger is negatively correlated with the price range even after controlling for industry-level unobservable heterogeneity. The economic magnitude is meaningful. As shown in Table 1, the standard deviation of the price range is 0.05. Then, the merger leads to a 0.4 standard deviation shrink of the price range.

The results of the control variables are as follows. *Price Range* is negatively correlated with the size of the firm, measured by total assets and profitability. This is supportive evidence of our assumption that price range is explained by asymmetric information, as asymmetric information is high for small firms and low-performing companies.

We also find that the price range is negatively correlated with R&D expenditure, which also supports the view that the price range is a function of asymmetric information, as it is difficult to evaluate firms with high intangible assets.

Lastly, we find that the secondary share ratio is negatively correlated with the price range. If managers have a strong incentive to disclose more private information when they sell at the timing of IPO, they are more likely to disclose information which narrow the filing range.

5.2 Offering price and price range

Next, we examine whether the offering price is set in the middle of the price range. The results are reported in Table 4.

Table 4, column 1 reports the results without industry-fixed effects. The estimated coefficient of our variable of interest, $Treat \times Post$, is positive ($p < 0.01$). The results indicate that the offering price of the IPOs after the merger between an investment bank

and a commercial bank is more likely to be set within the range. Table 4, column 2 of Table 4 shows the results with industry-fixed effects.

The results are similar even after controlling for industry-fixed effects: the merger between an investment bank and a commercial bank increases the probability that the offering price is set within the maximum or minimum price of the price range.

The economic size of the merger is nontrivial. The estimated coefficient is 0.08, which is almost equivalent to the probability of being in the middle of the price range (0.07).

6 Additional test

In this section, we conduct various additional cross-sectional analyzes to clarify the channel of our findings.

6.1 Lending relationship

Commercial banks can provide private information when there has been a loan contract between an issuer and a bank (**?**). Therefore, we predict that the amount of private information that can be used to determine the price range increases when the former loan relationship exists.

We test the role of lending relationships by estimating:

$$\begin{aligned} Y_{ijyu} = {} & \beta_1 Treat_{ut} \times Post_t \times Loan\ Repayment\ demand \\ & + \beta_2 Treat_{ut} \times Post_t \times Non\ Loan\ Repayment\ demand \\ & + \sum \gamma X_{ijyu} + \alpha + \alpha_u + \alpha_j + \alpha_y + \epsilon_{jiyu}, \end{aligned} \tag{3}$$

where the dependent variable Y is one $Range_{ijyu}$ or $Within\ Range_{ijyu}$. We add *Loan repayment demand*, which takes the value of one for IPOs that intend to use proceeds for loan repayment. In Japan, issuers are required to disclose their purpose to use the IPO proceeds. $Non\ Loan\ Repayment\ deman$ takes the value of one if the IPO's intend to use proceeds does not include loan repayment.

Furthermore, we add their interaction terms with $Treat \times Post$ that captures the heterogeneity of the availability of private information from the loan relationship.

The underwriter can access the private information when the relationship between the underwriter and commercial bank is strong especially when they try to maximize the proceeds at the IPOs. If the bank lends before IPOs and the firm plans to repay it using the proceeds, the investment and commercial banks would use the private information carefully, which affects the price filing range in the prospectus.

Table 5 shows the impact of the previous loan relationship on the determinants of the price range where the dependent variable is $Range_{ijyu}$ in columns 1 and 3 and $Within\ Range_{ijyu}$ in columns 2 and 4. In Table 5, column 1, we observe a statistically significant negative coefficient for the interaction term, indicating that issuers with loan repayment demand experienced a lower offer price adjustment after the bank merger. In Table 5, column 2, we observe that the coefficients of the interaction terms for whether the offer price is within the range are not statistically significant. It should be noted that in Table 5, columns 3 and 4, where we present the results after incorporating industry fixed effects, we observe an intriguing pattern. Although the coefficients remain similar, there is a reversal in the significance of the results. We find that mergers increase the probability that offer prices fall within the range of issuers with a demand for loan repayment.

From the perspective of coefficient signs, the results of the analysis indicate that the information production effect resulting from the combination of investment banks and commercial banks is more pronounced for firms that have existing lending relationships with commercial banks. The prevalence of credit relationships varies between industries and also differs in its dispersion within industries. For instance, in the information and communication technology industry, 27 percent of firms have credit relationships with banks, with an intra-industry standard deviation of credit relationships of 0.44. In contrast, in the precision machinery industry, 45 percent of firms have credit relationships with banks, with an intra-industry standard deviation of credit relationships of 0.51. Consequently, these findings

suggest that the effect of lending relationships on offer price adjustments primarily stems from inter-industry differences, while the effect on whether offer prices drop within a specific range is mainly driven by intra-industry variations.

6.2 Information asymmetry

Our argument assumes that the merger event improves the private information that the merged underwriter has, which affects the decision for filing range. The importance of private information by the underwriter on offering price depends on the degree of asymmetric information between investors and the issuer. Therefore, we conduct additional analyzes that show that the addition of the variable relates to the asymmetric information between the issuer and investors in order to examine the impact of the bank merger on determining the offering price.

Specificially, we test the role of lending relationship by estimating:

$$Y_{ijyu} = \alpha + \alpha_u + \alpha_j + \alpha_y + \beta_1 Treat_{ut} \times Post_t \times Asyn + \beta_1 Treat_{ut} \times Post_t + \sum \gamma X_{ijyu} + \epsilon_{jiyu}. \quad (4)$$

The variable $Asyn$ is an indicator of high asymmetric information. We employ three variables to measure the information asymmetry faced by issuers. First, we use the firm's R&D investments to gauge the level of information asymmetry. R&D investments create information asymmetries because issuers can observe changes in investment internally, while outsiders have access only to limited information. Second, we apply a dummy variable for issuer size, assigning a value of 1 if the dummy would take the value of 1 if the size is ranked among the bottom 25% and 0 otherwise. Smaller issuers often have fewer insiders and thus retain more proprietary information, posing a greater asymmetric information problem for investors. Finally, following the same logic, we use the firm age of the issuer as a proxy for information asymmetry. We assign a value of 1 for issuer's age is ranked among the bottom 25% and 0 otherwise. Similarly, younger issuers typically face more severe information asymmetry due

to their shorter track records and potentially less established reporting practices.

Table 6 shows the results. Panel A of Table 6 reports the results adding R&D expenditure as the degree of asymmetric information. We find that the price range narrows for the R&D intensive IPOs and the probability of being within the range increases after the merger event. This result supports the view that the merger underwriter can utilize its private information from its parent commercial bank to fix the filing range.

Panels B and C report the results after incorporating firm size and age as proxies for the degree of information asymmetry. We don't find clear evidence that the effect of mergers varies with the size or age of the issuing firms. This finding underscores the unique nature of information asymmetry stemming from R&D investments in the IPO issuance process. R&D projects, such as the development of novel pharmaceuticals or proprietary software, are often unique to the firm that is undertaking them, while capital investments like commercial real estate or aircraft typically share common characteristics between issuers within the same industry. Consequently, investors can derive little information about the value of an issuer's R&D activities from industry-wide data. **?** finds that R&D-intensive firms conduct more conference calls with analysts, implying a stronger investor demand for information about firms' R&D activities. Following a merger, banks have a stronger incentive to produce information related to R&D-intensive issuers that is of interest to investors, as this information is both more valuable and harder to obtain.

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6.3 Alternative explanation

There is the possibility that the merger of commercial and investment banks changes the certification role of the underwriter. If so, the price range changes not because of the increase in the private information that the underwriter has but because the merger attracts high-quality companies to be underwritten by the merged investment bank. If the quality of the companies relates to the price range, the decline of the price range comes from the change

of the underwriter's reputation instead of the increase in the private information that the underwriter has, as we predict. We tackle this possibility by two ways. First, we conduct the subsample period analysis. Second, we demonstrate the characteristics of the firms underwritten by the merged underwriter.

We examine this possibility by two types of additional analysis.

6.3.1 Sub-sample period analysis

We first test the alternative explanation of our finding by conducting an analysis with a subsample period, which restricts the sample of IPOs to one year after the merger.

Practically, an issuer determines the underwriter two to three years prior to their IPOs in Japan. Therefore, if the bank merger changes the underwriter's reputation and attracts high-quality companies, the impact comes three years or later.

Table 7 reports the results restricting the sample that went public within one year of the merger.

Table 7, column 1 reports the results where *Price Range* is the dependent variable. As in the previous analysis, the estimated coefficient of $Treat \times Post$ is negative and statistically significant.

Table 7, Column 2 reports the results where the dependent variable is an indicator for the within price range. In this case, we do not find evidence of increased frequency within the price range. As in the previous analysis, the estimated coefficient of $Treat \times Post$ is negative and statistically significant.

There is concern that the merger changes the characteristics of the firms underwritten by the merged underwriter. If, due to some reasons, issuers prefer the to be underwritten by bank-related underwriters, the merger changes the characteristics of the issuers between before and after the merger.

Therefore, we examine whether the characteristics of the offering and the characteristics change due to the merger. If a bank-related underwriter is preferred by more reputable firms,

the size of offerings and issuers becomes larger after the merger. Based on the argument, we examine the following estimation:

$$Size_{ijyu} = \alpha + \alpha_u + \alpha_j + \alpha_y + \beta_1 Treat_{ut} \times Post_t + \sum \gamma X_{ijyu} + \epsilon_{jiyu}, \tag{5}$$

where the size is the size of offering ($Proceeds$) and firm size($AssetSize$). The main explanatory variables are $Treat \times Post$. If the underwriter experienced that the merger can attract good quality companies, the size of the issuers would become larger. If so, we expect a positive coefficient for the interaction term.

Table 8 shows the characteristics of the IPO issuers underwritten by Nikko, the merged underwriters, before and after the event by estimating Eq. 8. The estimated coefficients of $Treat \times Post$ are statistically insignificant in both columns.

The results reject the possibility that the merged underwriter can attract good issuers by being the stronger bank relationship. Therefore, the relationship between the merger event and the filing range is not caused by the fundamental differences between IPO firms after the merger event.

6.4 Matched sample analysis

Next, we examine the possibility that the characteristics of issuers underwritten by the merged underwriter are different from that of other issuers. Our previous analyses used a regression model to control the issuers' characteristics. However, the regression model assumes a linear relationship between the dependent variable and the independent variable. If we cannot assume this assumption, regression models produce biased estimates. Moreover, the number of issuers of the merged underwriter is smaller than the others, which would also lead to biased estimates.

We apply the propensity score matching-difference in differences (PSM-DiD) method to further verify the robustness of the results. PSM-DiD mainly consists of the following steps:

First, we use a logit model to estimate the probability of a company being underwritten by Nikko Securities. The model incorporates the following explanatory variables: Asset size, EBITDA ratio, R&D, Cash, Secondary share, and Proceeds. Next, based on the underwriting probabilities obtained from the logit estimation, we match issuers underwritten by Nikko with those not underwritten by Nikko using caliper matching. To ensure high-quality matches, we: a) Impose the common support condition, which excludes treatment observations whose propensity scores fall outside the range of the control group's propensity scores. b) Set the caliper at 0.05, which means that matches are only accepted if the difference in propensity scores between the treated and control units is less than 0.05. Finally, we calculate PSM-DiD estimates according to Eq 3 weighted by propensity scores.

Table 9 reports the results with the observation of the treated and matched firms. The treated group consists of the firms underwritten by the merged underwriter, and matched firms are chosen for each treated issuer. The sample size declines as a result of the restriction of the observations.

The empirical findings are similar to those we have already observed. We find that the merger with commercial banks enables the underwriter to narrow down the filing range (column 1) and increases the probability that the offering price is within the range (column 2) after controlling for various factors that may affect the filing range.

7 Post-IPO Stock Returns

Lastly, we examine whether the information production due to the merger affects the post-IPO stock performances, especially the initial return and long-term return. Some may argue that the merger between an underwriter and a commercial bank can influence the stock returns around and after IPOs.

We also examine the impact of the merger event influences the underpricing. In this aim, we use underpricing, which is defined as the difference between the open price on the IPO

day and the offering price divided by the offering price as the dependent variable.

Previous studies have found various determinants of underpricing, including asymmetric information. Table 10 shows the results of the estimation. We find evidence that the merger event influences the underpricing, as the estimated coefficient of $Treat \times Post$ is statistically insignificant.

Next, we investigate whether the merger event influences the long-term return of IPO stocks. Table 11 shows the results in which long-term returns are used as the dependent variable. Dependent variables are buy-and-hold abnormal returns for 1 to 3 years from the IPO date. We also control for various factors that may affect long-term returns. Even after controlling for various factors, we find the positive coefficient in $Treat \times Post$, which indicates that the issuers with the merged underwriters outperform their counterparts. The positive long-term abnormal return implies that they are value-creative.

8 Conclusion

This paper argues the role of underwriters' private information-generating process by focusing on the filing range and utilizing the data of Japanese IPOs for two reasons. First, we are able to use the merger event between investment and commercial banks in Japan. Second, in the Japanaese bookbuilding process, the filing range is determined by the underwriters' information. The idea of our paper is that the merger with commercial banks increases the volume of private information that underwriters have. If the private information is used to determine the filing range, the underwriter with the private information of commercial banks can propose more narrow filling range for investors participating to the book-building process.

Our empirical analyses support our prediction. We find that firms underwritten by the merged underwriter propose narrow filing range and their offering prices are more likely to be in the range indicating that their filing range are informative.

Unlike previous studies, our article provides evidence of information production by underwriters without using underpricing, which is determined by various factors.

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Table 3: Determinants of the price range

This table reports the determinants of the price range, *Price Range*. The definitions of variables are summarized in the Appendix. OLS estimates are used in both estimations. Both columns use underwriter and year fixed effects. Column 2 adds industry-fixed effects. Standard errors after controlling the clustering at the underwriter-level are reported in the parentheses. ***, **, and * reports the statistical significance at the 1, 5, and 10% levels respectively.

	(1) *Price Range*	(2) *Price Range*
Treat×Post	-0.0237***	-0.0241***
	(0.00854)	(0.00835)
Asset size	-0.00853***	-0.00735***
	(0.000906)	(0.00117)
EBITDA ratio	-0.000521***	-0.000473***
	(0.000119)	(0.0000831)
R&D	-0.00152***	-0.00133***
	(0.000348)	(0.000244)
Cash	0.00605	0.00390
	(0.00664)	(0.00547)
Leverage	0.00128	0.00215
	(0.00787)	(0.00709)
Secondary share	-0.0180***	-0.0211***
	(0.00454)	(0.00528)
Proceeds	0.00409**	0.00402**
	(0.00178)	(0.00171)
Underwriter FE	Yes	Yes
Industry FE	No	Yes
Year FE	Yes	Yes
Observations	1602	1598

Table 4: Probability that offering price is determined in the middle of the price range
This table reports the determinants of the price range, *Within Range*. The definition of variables are summarized in Appendix. OLS estimates are used in both estimations. Both columns use underwriter and year fixed effects. Column 2 adds industry fixed effects. Standard errors after controlling the clustering at the underwriter level are reported in the parentheses. ***, **, and * reports the statistical significance at the 1, 5, and 10% levels respectively.

	(1) Within the filing range	(2) Within the filing range
Treat×Post	0.0766***	0.0831***
	(0.0121)	(0.0125)
Asset size	0.0208***	0.0215***
	(0.00382)	(0.00628)
EBITDA ratio	0.000130	0.00000607
	(0.000134)	(0.000203)
R&D	0.000230	-0.000337
	(0.000512)	(0.000733)
Cash	0.00197	-0.00661
	(0.0239)	(0.0254)
Leverage	-0.0202	-0.0265
	(0.0525)	(0.0634)
Secondary share	0.0627***	0.0576**
	(0.0219)	(0.0242)
Proceeds	-0.00301	-0.00330
	(0.00807)	(0.0119)
Underwriter FE	Yes	Yes
Industry FE	No	Yes
Year FE	Yes	Yes
Observations	1603	1599

Table 5: Heterogeneous Effects: Lending Relationship

We add *Loan repayment demand* that takes the value of one for IPOs intending toe use proceeds for loan repayment. Standard errors after controlling the clustering at the *** level are reported in the parentheses. Columns 1 and 3 use Price range, and columns 2 and 4 use within range indicator for dependent variable. ***, **, and * reports the statistical significance at the 1, 5, and 10% level respectively

	Offer price adjustment		Within the filing range	
	(1)	(2)	(3)	(4)
Treat×Post×Loan repayment demand	-0.0215**	-0.0217**	0.0809***	0.0902***
	(0.00934)	(0.00840)	(0.0127)	(0.0141)
Treat×Post×Non Loan repayment demand	-0.0250***	-0.0255***	0.0742***	0.0792***
	(0.00810)	(0.00834)	(0.0119)	(0.0120)
Controls	Yes	Yes	Yes	Yes
Underwriter FE	Yes	Yes	Yes	Yes
Industry FE	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	1602	1598	1603	1599

Table 6: Heterogeneous Effects: Information Cost

This table reports the impact of information cost on the sensitivity of the underwriter and bank merger event on the IPO filling range. The degree of information asymmetry is measured by the R&D expenditure (Panel A), firm age (Panel B), and Firm size (Panel C). The variable *R&D* takes the value of one if the firms disclose R&D expenditure, *Young* takes the value of one if the firm age at the timing of IPO is younger than the 25 percentile, and *Small* takes the value of one for a firm with total asset is less than the 25 percentile. In each panel, columns 1 and 3 use price range, and columns 2 and 4 use the indicator for within range. Columns 3 and 4 show the results with industry fixed-effects. Standard errors after controlling the clustering at the underwriter level are reported in parentheses. ***, **, and * report the statistical significance at the 1, 5, and 10% levels, respectively.

Panel A R&D expenditure

	Offer price adjustment		Within the filing range	
	(1)	(2)	(3)	(4)
Treat×Post×R&D	-0.157***	-0.143***	1.008***	0.849***
	(0.0127)	(0.0125)	(0.0962)	(0.0928)
Treat×Post	-0.0195**	-0.0204**	0.0612***	0.0703***
	(0.00895)	(0.00870)	(0.0117)	(0.0118)
Underwriter FE	Yes	Yes	Yes	Yes
Industry FE	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	1602	1598	1603	1599

Panel B Firm Age

	Offer price adjustment		Within the filing range	
	(1)	(2)	(3)	(4)
Treat×Post×Young	0.00384	0.00725*	0.0901**	0.0684**
	(0.00304)	(0.00369)	(0.0329)	(0.0251)
Treat×Post	-0.0239**	-0.0253***	0.0534***	0.0649***
	(0.00902)	(0.00910)	(0.0165)	(0.0152)
Underwriter FE	Yes	Yes	Yes	Yes
Industry FE	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	1602	1598	1603	1599

Panel C Firm Size

	Offer price adjustment		Within the filing range	
	(1)	(2)	(3)	(4)
Treat×Post×Small	-0.00790**	-0.00664*	0.0179	-0.00320
	(0.00335)	(0.00390)	(0.0285)	(0.0213)
Treat×Post	-0.0219**	-0.0229***	0.0701***	0.0821***
	(0.00798)	(0.00749)	(0.0143)	(0.0131)
Underwriter FE	Yes	Yes	Yes	Yes
Industry FE	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	1602	1598	1603	1599

Table 7: Sub-Sample Period

This table reports the results with sample covering one-year after the merger. Dependent variable is *Price Range* in column 1 and *Within Range* in column 2.

	(1) Offer price adjustment	(2) Within the filing range
Treat×Post	-0.0940***	0.0348
	(0.0110)	(0.0678)
Proceeds	0.0101***	-0.0212
	(0.00177)	(0.0270)
Asset size	-0.01000***	0.0266*
	(0.00196)	(0.0135)
EBITDA ratio	0.00557	0.0405
	(0.00972)	(0.0343)
Leverage	0.00430	-0.0486
	(0.00962)	(0.0856)
R&D	0.0104	0.0538
	(0.0180)	(0.0673)
Cash	-0.00760	0.0203
	(0.0105)	(0.0441)
Secondary share	-0.0230***	0.0643
	(0.00774)	(0.0412)
Underwriter FE	Yes	Yes
Industry FE	Yes	Yes
Year FE	Yes	Yes
Observations	901	902

Table 8: Changes in the Characteristics of issuers
This table reports the estimated coefficients from Eq. . Column 1 Proceed. Columns 2 Size. ***, **, and * indicate statistical significance at the 1, 5, and 10% level, respectively.

	(1) Proceeds	(2) Asset Size
Treat×Post	-0.0354	-0.169
	(0.101)	(0.118)
Treat	0.255	0.181
	(0.217)	(0.206)
EBITDA ratio	-0.000725	0.00105*
	(0.00134)	(0.000571)
Leverage	-0.596***	0.669***
	(0.108)	(0.0973)
R&D	-0.000825	0.00724***
	(0.00401)	(0.00157)
Cash	-0.863***	-2.010***
	(0.163)	(0.199)
Secondary share	0.977***	0.310*
	(0.196)	(0.182)
Underwriter FE	No	No
Industry FE	Yes	Yes
Year FE	Yes	Yes
Observations	1611	1611

Table 9: Estimations with Matched Sample

This table shows the results with matched sample where column 1 uses *Price Range* and column 2 uses as the dependent variable. The definitions of variables are summarized in Appendix. OLS estimates are used in both estimations. Both columns use underwriter and year fixed effects. Column 2 adds industry fixed effects. Standard errors after controlling the clustering at the underwriter level are reported in the parentheses. ***, **, and * reports the statistical significance at the 1, 5, and 10% levels respectively.

	(1) Offer price adjustment	(2) Within the filing range
Treat×Post	-0.0252***	0.0780***
	(0.00898)	(0.00927)
Asset size	-0.00978***	0.0215***
	(0.00120)	(0.00606)
EBITDA ratio	-0.00000629	0.0624
	(0.0124)	(0.0594)
R&D	0.0243	0.275**
	(0.0234)	(0.112)
Cash	-0.00290	0.0112
	(0.00906)	(0.0418)
Leverage	0.00635	0.00153
	(0.00972)	(0.0578)
Secondary share	-0.0167***	0.0792***
	(0.00548)	(0.0259)
Proceeds	0.00688***	-0.0154
	(0.00182)	(0.0118)
Underwriter FE	Yes	Yes
Year FE	Yes	Yes
Observations	1226	1226

Table 10: Underpricing

This table reports the results where the dependent variable is the underpricing. The definition of variables are summarized in Appendix. OLS estimates are used in both estimations. Both columns use underwriter and year fixed effects. Column 2 adds industry fixed effects. Standard errors after controlling the clustering at the underwriter level are reported in the parentheses. ***, **, and * reports the statistical significance at the 1, 5, and 10% levels respectively.

	(1) Initial return	(2) Initial return
Treat×Post	0.0953	0.0979
	(0.0591)	(0.0656)
Asset size	-0.104***	-0.0663***
	(0.0248)	(0.0226)
EBITDA ratio	-0.00326***	-0.00295*
	(0.000876)	(0.00151)
R&D	-0.0145***	-0.0125**
	(0.00236)	(0.00458)
Cash	0.487***	0.392***
	(0.0965)	(0.116)
Leverage	-0.286	-0.298
	(0.198)	(0.189)
Secondary share	-0.364***	-0.351***
	(0.0687)	(0.0821)
Proceeds	-0.208***	-0.246***
	(0.0631)	(0.0652)
Underwriter FE	Yes	Yes
Industry FE	Yes	Yes
Year FE	Yes	Yes
Observations	1564	1559

Table 11: Long-run return

This table reports the results where the dependent variable is the long-term returns. The definition of variables are summarized in Appendix. OLS estimates are used in both estimations. Both columns use underwriter and year fixed effects. Column 2 adds industry fixed effects. Standard errors after controlling the clustering at the *** level are reported in the parentheses. ***, **, and * reports the statistical significance at the 1, 5, and 10% levels respectively.

	(1) BHR(1 year)	(2) BHR(2 year)	(3) BHR(3 year)
Treat×Post	0.171**	0.348***	0.445***
	(0.0650)	(0.0730)	(0.0329)
Asset size	0.0510***	0.108**	0.159***
	(0.0161)	(0.0421)	(0.0570)
EBITDA ratio	0.000811**	-0.000285	0.0101***
	(0.000302)	(0.00137)	(0.00147)
R&D	-0.00000965	-0.00370	0.0226***
	(0.00123)	(0.00442)	(0.00511)
Cash	0.305**	0.477	0.621**
	(0.137)	(0.293)	(0.294)
Leverage	0.189**	0.140	0.201
	(0.0799)	(0.108)	(0.195)
Secondary share	0.159	0.241	0.233
	(0.101)	(0.189)	(0.249)
Proceeds	-0.0581**	-0.124***	-0.182***
	(0.0229)	(0.0288)	(0.0422)
Underwriter FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	1599	1599	1599

Supplementary Appendix

We show the definition of variables used in our study in Section Sec:APDX:Definitions.

A-1 Variable definition

This appendix section explains the definitions of variables used in this paper. The variable names are written in *italic* font. Data sources are expressed in **bold font**.

Price Range measures the width of the filing range defined as $Price\ Range = \frac{Offeringprice - Midpoint}{Midpoint}$, where $Midpoint = (Maximum + Minimum)/2$. $Offeringprice$ is the offering price of the IPO stock. $Maximum$ and $Minimum$ represent the maximum and minimum of the filing range. **INDB's Funding Eye**

Within Range is an indicator that takes the value of one if the offering price is smaller than the Maximum and larger than the minimum, and equals 0 otherwise. **INDB's Funding Eye**

$Treat$ takes the value of one for the IPOs underwritten by the merged underwriter, Nikko. *Post* is an indicator for IPOs underwritten after the merger event. *Asset size* represents the firm size defined as the natural logarithm of total assets. **Nikkei NEEDs**

EBITDA ratio represents profitability defined as the sum of Operating profit and Depreciation divided by revenue. **Nikkei NEEDs**

R&D represents the R&D ratio defined as research and development expenses divided by total revenue. **Nikkei NEEDs**

Cash represents the cash ratio defined as the sum of cash and deposits divided by total assets. **Nikkei NEEDs**

Leverage represents financial leverage divided by the sum of short- and long-term liabilities Total liabilities divided by Total assets. **Nikkei NEEDs**

Secondary share represents the ratio of secondary shares defined as a total number of shares offered from existing shareholders divided by the sum of a total number of shares offered from existing shareholders and the number of new shares. **INDB's Funding Eye**

Proceed represents the size of the funds raised at the IPO offering, defined as the natural logarithm of the total amount raised at the offering. **INDB's Funding Eye**

Initial Return: represents the underpricing defined as $\frac{First-day\ closingprice-Offering\ price}{Offering\ price}$. **INDB's Funding Eye**

$BHAR_1$ is a one-year buy-and-hold abnormal return defined as $BHR_{i,1yr} - BHR_{market,1yr}$. **Nikkei NEEDs**

$BHAR_2$ is a two-year buy-and-hold abnormal return defined as $BHR_{i,2yr} - BHR_{market,2yr}$. **Nikkei NEEDs**

$BHAR_3$ is a three-year buy-and-hold abnormal return defined as $BHR_{i,3yr} - BHR_{market,3yr}$. **Nikkei NEEDs**