Private information acquisition by underwriters

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1 Introduction

The role of the underwriters is critical during the security issuance process. They can mitigate the asymmetric information between the issuers and investors by acquiring private information (Booth and Smith (1986)). Acquiring information is critical, especially for IPOs, because a lack of track record in pre-issuance period causes highly degree of asymmetric information.

Previous IPO researches have examined the role of underwriters' information production by focusing on the under pricing, while some studies find the supportive results (Carter and Manaster (1990)),the subsequent findings do not support it (Allen and Faulhaber (1989); Beatty and Welch (1996); Loughran and Ritter (2001)). The reason for the inconclusive findings would come from the fact that the underpricing is caused by various factors, including investor sentiment, market condition, 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, we exploit the event of the merger between the investment and commercial banks in Japan. In 2012, SMBC, one of the largest commercial bank acquired Nikko Securities, one of the three largest investment bank in Japan. The merger enable 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 the investment banking businesses, including underwriting equities citePuri1999) and bonds (Yasuda (2005)).

Therefore, an investment bank can utilize private information when merging with a commercial bank for price adjustment.

The second reason for focusing on the Japanese comes from its unique institutional setting, which enables us to use the filing range at the bookbuilding process as the proxy of the private information of underwriters.

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

This paper focuses on the price filing range at the book-building process instead of the underpricing due to the two key features of the Japanese IPO process.[2] First, in Japan, the majority of investors allocated the IPO shares are individual investors where, as the majority of shares are allocated for institutional investors in 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. Second, 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.

In such situation, the information production process by underwriter is critical as the institutional investors have less incentive to provide their private information. As explained, the offering price is strictly determined within the price range before the bookbuilding in the Japanese IPO process. In such a situation, an underwriter and an issuer face the trade-off for selecting a price range. On the one hand, they prefer to make the range as wide as possible. The investor demand of IPO shares is determined after fixing the filing range.

As the offering price should be within the range, a low maximum price leads to a concern for high underpricing. On the other hand, 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. Conversely, because, unless the offering 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 unconstrained, 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.

Why interesting?: Many studies have shown the information generation process by underwriters (Booth and Smith (1986); Puri (1999)). A selection problem exists. Good companies choose good underwriters. Fewer studies have used exogenous shock.

We use an event in an investment bank that a commercial bank acquires. Specifically, we use the acquisition of Nikko Securities by Sumitomo Mitsui Group as the event. Nikko was one of the top four securities companies in Japan. During the banking crisis in Japan in the 1990s, it recorded a severe volume of losses, which led to Nikko's severe financial deficit. Then, it was acquired by Citi Corp. Salomon Brothers was acquired by Citi Corp. Citi attempted to dissolve the relationship with Nikko. Then, in 2009, a big

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

commercial bank, Sumitomo Mitsui Bank, acquired Nikko.

The merger enables the investment bank to exploit the private information that the commercial bank owns.

Empirical results: The empirical findings are as the follow. First...

Contributions: This paper contributes to various

2 Institutional setting

This section explains the background of our study. First, we review the process of determining IPO offering price in Japan. Next, we report the detail of the merge of Nikko with 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 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 prevailing 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 commences on the stock exchange. The first traded price, typically set by the opening auction on the inaugural day, is the "initial price."

The book-building process of Japan is different from that in the US as shown in Figure1. First, while in the US, underwriters conduct pre-hearing for verouls institutional investors who potentially purchases the IPO shares. The filling range is determined based on the results of pre-hearing. Based on the filling range, the underwriters conduct roadshow for various intitutional investors and then order book is built. In Japan, filing range is determined based on the results of roadshow. The underwriters build odering book based on the filling range.

It is noteworthy to mention two more Japan unique aspects of Japanese bookbuilding process. First one is the Nature of the filing range. In the U.S., the filing range is flexible. The final offering price may surpass the upper limit if investor demand exceeds initial expectations. Conversely, 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 demand strength, 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 investors. In the U.S., the lead underwriter's demand survey and the primary allocation of new shares target institutional investors.

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.

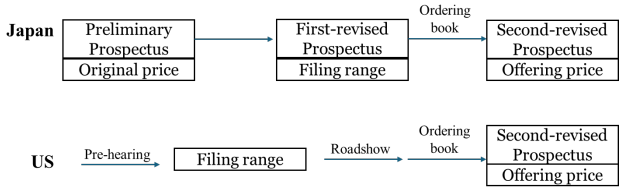

Figure 1: IPO underwriting process in Japan

2.2 Merger Event

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 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 could share 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 Nikko. $Post$ is an indicator for IPOs underwritten after 20XX. 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, 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 cyclitality of IPO markets. Therefore, we add year fixed effects (α_y). We also control industry-level heterogeneity in 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 the dependent variable is $Within\ Range$ 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 same with the maximum or minimum of the price range.

We estimate Eq. 4 with linear probability model with OLS estimates.

4.1 Control variables

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

The definition of the variables are explained in Table **??**.

4.2 Data

We collect the IPO information from INDB's Funding Eye database. The Funding Eye collects the detailed information of securities issuance in the Japanese stock market. It covers the equity issuance by listed

Table 1: Dynamics of the underwriter market in Japan

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%

companies in Japanese stock markets. We restrict the records tagged as "IPOs" from Funding Eye.

We collect the stock price information and accounting information from Nikkei's NEEDS FinancialQUEST service, which is widely used in the analysis targeting Japanese listed companies. The data coves all listed companies in all stock exchanges in Japan. Table A-3 reports the summary statistics of the variables used in this study.

The sample period of this paper covers from 2000 to 2022. The lead underwriter is collected from the Funding Eye. In the case of global offering, usually domestic and international underwriter co-work. In this case, we regard the domestic bank as the lead underwriter. Table 1 shows the time-series trend of the underwriter shares by so called top-3 securities companies (Nomura, Nikko, and Daiwa).

5 Empirical results

5.1 Determinants of the price range

We start our analysis from examining the relationship between the bank merger and price range by estimating Eq 4.

Table 2 reports the estimated coefficients the dependent variable is the price range. Column 1 reports

the results without industry-fixed effects. The estimated coefficient of our variable of interest,$Treat \times Post$, is negative ($p < 0.01$).

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

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

Lastly, we find that the secondary share ratio is negatively correlated with the price range.

5.2 Offering price and price range

We, next, examine whether the offering price is set in the middle of the price range. The results are reported in Table 3.

Table 3, 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 are more likely to be set within the range. Table 3, column 2 of Table 3 shows the results with industry-fixed effects.

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

The economic size of the merger is non-trivial. The estimated coefficient 0.08, which is almost equivalant to the probability to be the middle of the price range (0.07).

6 Additional test

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

Table 2: Determinants of the price range
This table reports the results where the dependent variable is the price range. 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% level respectively

	(1) Offer price adjustment	(2) Offer price adjustment
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 3: Probability that offering price is determined in the middle of the price range
This table reports the determinants of the offering price determined in the filing range. ***, **, and * reports the statistical significance at the 1, 5, and 10% level 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

6.1 Lending relationship

Commercial banks can provide private information when there had been the 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 relationship by estimating:

$$Y_{ijyu} = \alpha + \alpha_u + \alpha_j + \alpha_y + \beta_1 Treat_{ut} \times Post_t + \sum \gamma X_{ijyu} + \epsilon_{jiyu}, \tag{3}$$

Y = a + b1*Treat*After*Loan + b2*Treat*After*not-Loan ..... not-Loan = (Loan + 1)*-1

, where the dependent variable Y is one $Range_{ijyu}$ or $Within\ Range_{ijyu}$. We add *Loan repayment demand* that takes the value of one for IPOs intending to use proceeds for loan repayment. In Japan, issuers are required to disclose their purpose to use the IPO proceeds. Furthermore, we add its interaction term with $Treat \times Post$ that captures the heterogeneity of the availability of private information from the loan relationship.

The underwriter with strong commercial bank-relationship may exploit their private information especially when they try to maximize the proceeds at the IPOs. If the bank lend before IPOs and the firm plan to repay it using the proceeds, the investment and commercial banks would use the private information carefully, which affect price filing range at the prospectus.

Table 4 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 4, 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 4, 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 4, 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 for issuers with a demand for loan repayment.

From the perspective of coefficient signs, the analysis results 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 across 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 improve the private information that the merged underwriter has, which affect the decision for filing range. The importance of the private information by underwriter on offering price depends of the degree of asymmetric information between investors and the issuer. Therefore, we conduct additional analyses that adding 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 for the 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, whereas 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 issuer age 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 5 shows the results. Panel A of Table 5 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 probability to be within the range increases after the merger event. This support the view that merger underwriter can utilize its private information from its parent commercial bank for fixing 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

Table 4: 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 parenthes. 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	-0.00825**	-0.00609	0.0251	0.0340**
	(0.00379)	(0.00365)	(0.0169)	(0.0132)
Treat×Post	-0.0206**	-0.0218**	0.0653***	0.0691***
	(0.00852)	(0.00875)	(0.0111)	(0.0129)
Asset size	-0.00843***	-0.00730***	0.0203***	0.0209***
	(0.000931)	(0.00117)	(0.00381)	(0.00629)
EBITDA ratio	-0.000523***	-0.000477***	0.000117	-0.0000111
	(0.000116)	(0.0000814)	(0.000141)	(0.000209)
R&D	-0.00152***	-0.00133***	0.000217	-0.000357
	(0.000343)	(0.000240)	(0.000529)	(0.000749)
Cash	0.00666	0.00423	-0.00202	-0.00934
	(0.00661)	(0.00556)	(0.0243)	(0.0257)
Leverage	0.000781	0.00175	-0.0167	-0.0218
	(0.00807)	(0.00734)	(0.0523)	(0.0624)
Secondary share	-0.0172***	-0.0207***	0.0592**	0.0536**
	(0.00475)	(0.00546)	(0.0225)	(0.0251)
Proceeds	0.00387*	0.00388**	-0.00204	-0.00237
	(0.00190)	(0.00177)	(0.00808)	(0.0120)
Loan repayment demand	0.00161	0.000207	-0.0283**	-0.0259**
	(0.00367)	(0.00393)	(0.0131)	(0.0126)
Underwriter FE	Yes	Yes	Yes	Yes
Industry FE	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	1602	1598	1603	1599

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 undertaking them, whereas capital investments like commercial real estate or aircraft typically share common characteristics across 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. Tasker (1998) 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.

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 test 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 within 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 attract high quality companies, the impact comes three year or later.

Table 6 reports the results restricting the sample that went public within one year of the merger.

Table 6, Column 1 reports the results where the *Price Range* is the dependent variable. As with the previous analysis, the estimated coefficient of the $Treat \times Post$ is negative and statistically significant.

Table 6, Column 2 reports the results where the dependent variable is an indicator for the within price range. In this case, we do not find the evidence of the increase of frequency to be within the price range. As same with the previous analysis, the estimated coefficient of the $Treat \times Post$ is negative and statistically significant.

Table 5: Heterogeneous Effects: Information Cost

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 ind FE.

Standard errors after controlling the clustering at the *** level are reported in the parenthes. ***, **, and * reports the statistical significance at the 1, 5, and 10% level respectively.

Panel A R&D expenditure

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

Panel B Firm Age

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

Panel C Firm Size

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

Table 6: 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

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 7 shows the characteristics of the IPO issuers underwritten by Nikko, the merged underwriters, before and after the event by estimating Eq. 7. 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.

Table 7: 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

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 mathcing-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, meaning 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 estimate according to Eq 4 weighted by propensity scores.

Table 8 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 due to 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 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 merge between an underwriter and a commercial bank can influence the stock returns around and after IPOs. Indeed, several studies have been

We test whether the merger event influences the underpricing. In this aim, we use underpricing, which

Table 8: Estimations with Matched Sample
Column 1 Price range. Columns 2 within range. ***, **, and * indicate statistical significance at the 1, 5, and 10% level, 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

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 9 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 10 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 reported high long-term returns.

Table 9: Underpricing
***, **, and * indicate statistical significance at the 1, 5, and 10% level, 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

8 Conclusion

This paper argues the role of the private information generating process by underwriters by focusing on the filing range utilizing the data of Japanese IPOs.

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Table 10: Long-run return

	(1) BHR(1 year)	(2) BHR(1 year)	(3) BHR(1 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

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Supplementary Appendix

This document contains additional materials.

A-1 Variable definition

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

Price Range measures the width of the filing range defined as $(Offeringprice–MidpointoftheRange)/(MidpointoftheR$ where Midpoint of the $Range = (Maximum + Minimum)/2$. $Offeringprice$ 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 variable representing the Offering price is smaller than the Maximum and larger than the Minimum; = 0 otherwise. **INDB's Funding Eye**

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 Sales 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 Returns: represents the underpriceing defined as $(Firstaftermarketprice–Offeringprice)/(Offeringprice)$**INDB' Funding Eye**

BHR(1 year) is one year buy-and-hold abnormal return defined as $BHR(1year)$-$BHR_market(1year)$. **Nikkei NEEDs**

BHR(2 year) is two year buy-and-hold abnormal return defined as $BHR(2year)$-$BHR\_matched(2year)$.

Nikkei NEEDs

BHR(3 year) is three year buy-and-hold abnormal return defined as $BHR(3year)$-$BHR\_matched(3year)$.

Nikkei NEEDs

Table A-3: Summary Statistics
This table reports the summary statistics of the variables used in this study.

	mean	sd	p50	p25	p75
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
Observations	2037				