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Do Underwriters Short-Change Corporations Issuing Bonds?

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Abstract

We confirm prior evidence that bonds on average are offered at prices below their immediate post-offer secondary market prices. However, in cases where banks lead–manage their own bond offerings the underpricing is significantly less as compared with other non-self-marketed offerings. These findings are robust across various matched samples and selection models. Our results suggest that the bond offering process is characterized by substantive agency conflicts between shareholders of corporations (issuers) and underwriters.

I. Introduction

Since Ederington (1974), numerous studies have documented evidence of underpricing of corporate bond offerings, albeit with considerable cross-sectional variation. For example, Datta, Iskandar-Datta, and Patel (1997) and Cai, Helwege, and Warga (2007) find underpricing for high-yield initial bond offerings (IBOs), while Goh, Malatesta, and Yang (2020) find significant underpricing for both investment grade and high-yield offerings. Given the enormous size of the bond market, any inefficiency in its capital raising process will be particularly costly to issuing companies.[1] For example, Bloomberg reported "a 1-day profit of $2.54 billion reaped by buyers of Verizon Communications Inc.'s $49 billion offering in Sept. 2013, a deal for which money managers put in orders of as much as $100 billion."[2] The quick profit to investors who received the offering allocation represents a cost to the shareholders of the issuing firm.

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[1]According to Security Industry and Financial Markets Association (SIFMA), from 2005 through 2017, U.S. firms issued a total of $15.5 trillion of corporate bonds as compared with $2.7 trillion in equity issues. http://www.sifma.org/research/statistics.aspx.

[2]"Bond Allocation Probe Seen Symptomatic of Race for Yield," Bloomberg, Mar. 4, 2014.

In this article, we investigate whether the underpricing of bond issues can be attributed in part to the existence of agency conflicts between issuers and underwriters.[3] Relevant agency-based theories propose that underwriting banks are better informed than issuing firms regarding the pricing and demand for the offerings through their expertise in book-building (Baron (1982), Biais, Bossaerts, and Rochet (2002)). These theories also suggest that banks may exert sub-optimal effort in marketing the security. Numerous empirical studies have provided evidence on possible self-dealing behaviors in the equity offering process (see Loughran and Ritter (2004), Reuter (2006), Hoberg (2007), Nimalendran, Ritter, and Zhang (2007), Goldstein, Irvine, and Puckett (2011), and Boeh and Dunbar (2016)). However, results from direct tests on whether the agency problem exacerbates underpricing are inconclusive (see Muscarella and Vetsuypens (1989), Ljungqvist and Wilhelm (2003), and Liu and Ritter (2010)). Unlike the equity market, the bond market offers a unique quasi-natural experimental setting to test the agency conflict-of-interest hypothesis. This is because underwriters themselves often issue significant amounts of bonds, and in many instances, they also act as lead managers. When banks lead–manage their own bond offerings, potential conflicts of interest between underwriters and issuers are mitigated.

We primarily study 1,666 investment grade seasoned bond offerings (SBOs) by 138 financial firms over the Feb. 2005 to Dec. 2017 period.[4] These financial institutions have SIC codes between 6000 and 6999, including commercial banks, investment banks, insurance companies, and credit institutions. Of the 1,666 financial bond issues, 710 are self-marketed by the issuing firms. An offer is defined as self-marketed if the issuer serves as one of the lead managers of the underwriting syndicate (Muscarella and Vetsuypens (1989)). We also assembled a sample of 3,541 SBOs by 480 non-financial firms to serve as control groups.

To directly test the agency conflict-of-interest hypothesis, we exploit a unique sample of bond offerings in which underwriters switch between self- and non-self-marketed offerings. To the best of our knowledge, this is the first study of security offerings of this nature. It is perhaps the cleanest test of the agency hypothesis because the only difference in the offerings is whether the SBOs are marketed by the issuing banks themselves or by other underwriters. With this sample, we compare underpricing between the 217 self-marketed and 76 non-self-marketed offerings by the same banks. For example, U.S. Bancorp self-marketed its bonds on Sept. 8, 2014, while on Jan. 26, 2016, U.S. Bancorp delegated the marketing of its SBOs to Goldman Sachs and Deutsche Bank. We find that the underpricing of the self-marketed SBOs averages 0.10% versus 0.27% for the non-self-marketed SBOs. The disparity in underpricing between self- and non-self-marketed bond issues of these banks is 0.17% and it is statistically significant at the 1% level.

[3]It is reported that the Security Exchange Commission is focusing on whether underwriting banks give preferential treatment to certain investors, thus allowing them to make quick profits by reselling bonds at higher prices to investors shut out of the deal initially. See "Regulators Probing How Goldman, Citi and Others Divvied Up Bonds," *Wall Street Journal*, Feb. 28, 2014 and "FINRA Scrutinizes Banks' Role in Bond Market," *Wall Street Journal*, Apr. 10, 2014.

[4]Note that SBOs are bond offerings issued by firms that already have publicly traded bonds outstanding at the time of the current offering, even though technically it is an initial offering of a new bond (see Caton, Chiyachantana, Chua, and Goh (2011)).

To control for potential endogeneity in the decision to self-market the bank's own SBOs, we use a selection model suggested by Bushee, Matsumoto, and Miller (2003) with known determinants of bond underpricing as controls.[5] For example, Cai et al. (2007) show that valuation uncertainty and information asymmetry are significant determinants of bond underpricing, implying that the disparity could be a result of the differential informational settings of the two samples. Corwin (2003) and Ellul and Pagano (2006) provide evidence that underpricing of equity offerings is related to liquidity. We control for these potential explanations by using proxies such as credit rating, maturity, the number of bond issues the issuer has outstanding, market-wide uncertainty, as well as offer size and liquidity measures in our selection models. Results from our selection models show that for the sample of banks that switch between self- and non-self-marketed SBOs, their self-marketed offerings are 0.15% less underpriced than their own non-self-marketed SBOs, after considering the possible self-selection bias. The difference in underpricing is statistically significant at the 10% level. Hence, both the univariate and selection regression results from this unique sample of switchers lend support to the agency hypothesis.

Next, we conduct further tests of disparities in underpricing using the full sample of corporate bond offerings from 2005 to 2017 by both financial and non-financial firms. First, we compare all the 710 self-marketed offerings, our treatment group, to 5 control groups. These are i) all of the 956 financial non-self-marketed offerings, ii) financial non-self-marketed offerings matched by rating, maturity, issuer's size, and the number of outstanding bond issues, iii) financial non-self-marketed offerings matched by rating, maturity, and offer size, iv) non-financial offerings matched by rating, maturity, issuer's size, and the number of outstanding bond issues, and v) non-financial offerings matched by rating, maturity, and offer size.

The average underpricing for the entire sample of 710 self-marketed SBOs over our sample period is 0.15% and it is significant at the 1% level. Comparing the treatment group's average underpricing with our 5 control groups, we find, the average underpricing of the 956 non-self-marketed financial SBOs is 0.34%. The difference, 0.19% (0.34%–0.15%) is statistically significant at the 1% level. In comparing the underpricing between self-marketed offers to the remaining four matched control samples of non-self-marketed SBOs, we find the disparity ranges from 0.11% to 0.19% when compared with matched financial control groups. For comparison with matched non-financial control groups, the disparity ranges from 0.17% to 0.23%. The differences in underpricing between the treatment and control groups are all statistically significant at the 1% level. To validate the robustness of these univariate results, we perform regression analyses on the 1,666 SBOs by financial firms with known determinants of underpricing as controls. Depending on model specifications, the self-marketed SBO dummy variables are negative and are statistically significant at the 5% to 1% level. Hence, our multiple regression results fully support the findings that self-marketed SBOs are significantly less

[5]Collinearity diagnostics on the independent variables in our sample show that the determinants in our model do not suffer from multi-collinearity issues. Given the absence of collinearity problems, Puhani (2000) suggests the full-information maximum likelihood estimator is preferred over the limited-information 2-step method of Heckman (1979).

underpriced than non-self-marketed ones, which lends further support to the agency hypothesis as an explanation for corporate bond underpricing.

Even though it appears that underpricing as a percentage of offer price is small, the economic impact of the disparity in underpricing is nontrivial. Given that the median size of a non-self-marketed financial SBO is approximately $600 million, the disparity in underpricing of 0.11% to 0.23% will translate into an average transaction cost difference of $0.7 to $1.4 million per deal to the issuers' shareholders. Given the size of the corporate bond issuance market of approximately $1 trillion per year, the added transaction cost to shareholders ranges from $1 to $2 billion annually.

In summary, we find significant and systematic disparity in underpricing between self-marketed and non-self-marketed investment grade corporate bond offerings. Our results lend direct support to the agency models of Baron (1982) and Biais et al. (2002), as we find that underwriters' self-marketed issues are significantly less underpriced than issues that are non-self-marketed. This article contributes to the literature on corporate bond offerings by showing that agency conflict of interest is a plausible explanation for the underpricing of corporate bond offerings. Our findings are also timely since it is reported that the SEC is probing underwriters' offering practices in the corporate bond market.

The remainder of the article is organized as follows: In Section II, we discuss the existing literature and develop testable hypotheses. Section III describes the data and key variables. Section IV presents evidence of bond underpricing and tests of the agency conflict-of-interest hypothesis, and Section V concludes the study.

II. Related Literature and Hypotheses Development

A. Existing Evidence and Explanations on Corporate Bond Underpricing

Over- or underpricing is typically estimated as the initial return from the offer price to the post-offer secondary market price. A positive initial return indicates underpricing. This initial return measure requires data on secondary market transaction prices. A comprehensive database of transaction prices was unavailable to researchers until 2005, when the Financial Industry Regulatory Authority introduced the Trade Reporting and Compliance Engine (TRACE) database. To circumvent the problem of the lack of transactions data, earlier studies examined the yield spreads between newly issued bonds and a benchmark index of seasoned bonds with similar credit rating and maturity (Ederington (1974), Lindvall (1977), and Sorensen (1982)). Datta et al. (1997) focus exclusively on IBOs on the NYSE (i.e., bond offerings by firms with no publicly traded bonds outstanding) and find underpricing for high-yield issues but *overpricing* for investment-grade issues. Relying solely on insurance company trades data, Cai et al. (2007) provide a more comprehensive analysis of bond underpricing during the 1995 through 1999 period. They find underpricing ranging from 0.17% (for SBOs) to 0.47% (for IBOs) among high-yield offerings but no significant underpricing for investment-grade issues. In a recent study, Goh et al. (2020) find significant underpricing for both investment and high-yield IBOs and SBOs. Unlike Cai et al. (2007), the Goh et al. (2020)

results are based on a comprehensive sample of corporate bond trades from the TRACE database.[6]

Cai et al. (2007) also test many theories relevant to bond underpricing. They find IBO underpricing to be higher among riskier companies. These are private firms for which the IBO is the very first public security offering. They also find larger underpricing for firms that have not issued bonds within the previous 2 years. These findings, in conjunction with their other results that only high-yield bonds are underpriced, suggest that underpricing may be the result of price uncertainty and information asymmetry (Allen and Faulhaber (1989), Grinblatt and Hwang (1989), Welch (1989), and Benveniste and Spindt (1989)).

In addition, other theories have been developed to explain underpricing of securities which include market liquidity. For example, Corwin (2003) posits and finds evidence suggesting that underpricing of seasoned equity offerings (SEOs) is used to compensate investors for absorbing price pressures due to a shift in the supply of an existing security. Ellul and Pagano (2006) argue that underpricing is used to compensate investors for post-offer secondary market illiquidity. However, Cai et al. (2007) do not find any empirical evidence suggesting that corporate bond underpricing is related to liquidity.

Other studies also report evidence that bond offerings are underpriced. For example, in a study of dealer behavior around offerings, Goldstein and Hotchkiss (2007) find some evidence of underpricing of investment-grade as well as high-yield debt offerings. However, their study amalgamated all debt offerings, including Rule 144A private placements that account for 54.1% of their sample. Kozhanov and Ogden (2012) study the liquidity of bond offerings, and they find that new bond issues have lower yields than comparable seasoned bond benchmarks, consistent with overpricing. Liu and Magnan (2014) use bond underpricing to study the conditional conservatism in financial reporting quality by combining both investment grade and high-yield bonds in their sample, and find corporate bonds are underpriced on average by 79 basis points.

B. Underpricing Arising from Agency Problems Between Issuers and Underwriters

Besides the price uncertainty and information asymmetry explanations offered by existing bond studies, another possible explanation of why firms leave money on the table can be attributed to potential agency problems between issuers and underwriters. In the offering process, the lead managers of the underwriting syndicate accept indications of interest from potential investors during book-building, develop the structure of the offering, and set the final offer prices. Issuing firms'

[6]Cai et al. (2007) study is based on secondary bond prices from the University of Houston – National Association of Insurance Commissioners database over the 1995 through 1999 periods. The UH-NAIC database includes trades by insurance companies only. Bessembinder, Maxwell, and Venkataraman (2006) note that transactions from insurance companies account for about 12.5% of dollar trading volume in TRACE-eligible securities. One difficulty in replicating Cai et al. (2007) using TRACE data is the difference in sample period. In July 2002, the National Association of Securities Dealers (NASD) began reporting over-the-counter trades of some bonds through its TRACE. By Feb. 2005, coverage was extended to virtually all corporate bond trades.

executives are generally not involved in the details of the book building process between underwriters and their buy-side clients. Therefore, the underwriters, especially the lead managers, should be better informed about investors' demand and offer prices than the issuing firms.

Baron (1982) argues that an underwriting bank's informational advantage over issuing companies might allow the bank to shirk in marketing and distribution of the security if the effort is not perfectly observable and verifiable. Benveniste and Spindt (1989) show that the magnitude of underpricing is contingent upon the amount of private information about the valuation of the shares that investors in the IPOs are willing to reveal to the underwriters. Building on the Baron (1982) and Benveniste and Spindt (1989) findings, Biais et al. (2002) show that underwriting banks with private information on demand and informed investors with private information on market valuation may collude to extract informational rents from issuers.

Recent research also explores potential agency conflicts due to joint production of underwriting and other financial services, such as brokerage, security analysis, lending, and asset management (Loughran and Ritter (2004)). The evidence suggests that underwriters may be extracting quid pro quo benefits such as charging higher trading commission fees (Reuter (2006), Hoberg (2007), Nimalendran et al. (2007), and Goldstein et al. (2011)). Hao (2007) suggests that underwriters, in a practice known as laddering, require investors to buy additional shares of the issuer in the aftermarket as a condition for receiving shares at the offer price. Liu and Ritter (2010) find executives who received side payments from underwriters, in the form of allocation of IPOs of other companies, put less emphasis on maximizing the proceeds from their own IPO, resulting in their own IPO being more underpriced.

To test whether such agency problems lead to underpricing, several studies compare the levels of underpricing associated with different degrees of agency problems. The implication is that smaller agency problems induce smaller underpricing. For example, Ljungqvist and Wilhelm (2003) find that offerings with greater investment banks' pre-IPO equity holding are less underpriced. Muscarella and Vetsuypens (1989) examine a set of equity IPOs self-marketed by the investment banks themselves in the 1970s and 1980s and find that these self-marketed IPOs appear to be underpriced by as much as other IPOs. Their finding does not support the agency hypothesis. However, as Ljungqvist (2004) points out, there are only 38 cases in which banks self-market their own IPOs, so the estimates of mean underpricing are imprecise.

In the bond market, there are many instances where banks lead–manage their own issues, thus mitigating the agency conflict-of-interest problem. There are also instances where banks switch between self- and non-self-marketing of their own SBOs. This unique circumstance enables us to set up our study as a quasi-natural experiment. The treatment group consists of self-marketed SBOs and the controls are groups of non-self-marketed SBOs. Since all self-marketed offerings are investment-grade seasoned offerings, we compare underpricing of self-marketed SBOs to various groups of investment-grade non-self-marketed SBOs. By focusing on investment-grade seasoned bonds and using the matched samples, we minimize concerns pertaining to valuation uncertainty and information asymmetry that

previous studies have shown as significant determinants of bond underpricing (e.g., Cai et al. (2007)). The agency hypothesis predicts, ceteris paribus, smaller underpricing when banks lead–manage their own SBOs.

III. Sample Description and Variable Construction

A. Data Sources

Data are collected from 5 main sources: i) Securities Data Company's (SDC) Global New Issues Database for corporate bond offerings; ii) Mergent Fixed Income Securities Database (FISD) for bond characteristics; iii) Enhanced TRACE for bond secondary market trades; iv) Bank of America Merrill Lynch Indices for bond market benchmark returns; and v) Prospectuses on the SEC Electronic Data Gathering, Analysis, and Retrieval (EDGAR) service.

We begin with the sample of all non-convertible corporate bonds issued by financial firms from Feb. 1, 2005 to Dec. 30, 2017 from the SDC database (we examine the sample of non-financial issues separately). The financial firms include commercial banks, investment banks, credit institutions, and insurance companies. We exclude Rule 144A issues and other private placements, pay-in-kind bonds, corporate pass-through trusts, agency issues, and bonds not denominated in USD. We further delete 104 puttable bonds, 86 emerging market issues, and 64 issues with non-fixed rate coupons or bonds with irregular coupon paying frequency. Subsequently, 3,764 issues remain.

Since SDC contains limited information on bond characteristics, we obtain face value, coupon, credit rating, and additional data from Mergent FISD. Of the 3,764 issues, we are able to match 2,836 to the FISD database.[7] Moody's credit rating is used if available; otherwise, Standard & Poor's or Fitch's rating is adopted.[8] We further delete 10 non-rated bonds and 64 bonds with face values not equal to $1,000. Both SDC and FISD provide detailed offering information, including issue date, offer price, offering yield, and maturity. Given potential errors in SDC's variables as reported by prior studies (Corwin (2003), Ljunqvist and Wilhelm (2003)), we cross-check these variables between SDC and FISD, and find 975 observations with discrepancies for one or more of the four variables. We then verify them against the prospectuses on EDGAR and Factiva news sources. We find many of the inconsistencies between SDC and FISD records are due to rounding errors, but 265 of these issues are not identifiable in either EDGAR or Factiva and are therefore deleted. We further delete 28 bonds issued by university endowment funds, 216 asset-backed pass-through securities or subordinate bonds misclassified as straight debts by SDC. We then further delete 197 bonds that are not rated as investment-grade.

[7]FISD and SDC are matched on bond CUSIP. If a bond issue has not been assigned a CUSIP in SDC, it is matched by issuer CUSIP, issue date, offer price, and offer yield.

[8]There are 75 observations with rating disagreement between Moody's and S&P, where one agency rated as investment grade and the other rated as high yield. In these cases, we adopt the higher rating for two reasons. First, the related SEC rule suggests "at least one NRSRO" for determining whether an issue is rated as investment grade. Second, SDC classifies all these observations as investment-grade issues.

Secondary market bond trade prices and trading volume are obtained from the enhanced TRACE database. Enhanced TRACE also reports whether a trade represents a customer-to-dealer buy, a customer-to-dealer sell, or an inter-dealer trade. This allows us to estimate underpricing while taking into account bid–ask bounces. Following Dick-Nielsen (2009), we eliminate duplicate, canceled, withdrawn and reversed transactions, and then calculate bond underpricing (described in Section III.B). After matching the underpricing measures, our final financial sample consists of 1,666 investment-grade bond offerings by 138 financial firms.[9]

We define a bond offering as self-marketed if the issuer is one of the lead managers; this is the way in which Muscarella and Vetsuypens (1989) define self-marketed equity IPOs. They further state that "the issuer-underwriters' influence in setting the price of its own offering is likely … to be the greatest when the issuer acts as lead manager." Of the 1,666 financial offerings, 710 are self-marketed and 956 are non-self-marketed. For our sample, most of the bond offerings have multiple lead managers. The mean and median number of lead managers (bookrunners) is 3.1 and 3. Out of the 1,666 bond offerings, 443 have solo bookrunners. For the 710 self-marketed offerings, 317 have multiple bookrunners. Note that some of these financial firms do issue multiple bonds on the same day with different maturities. In this sample of 1,666 offerings, 991 are single SBOs, of which 448 are self-marketed and 543 are non-self-marketed. SBOs with two bonds being issued on the same day totals 552, of which 188 are self-marketed and 364 are non-self-marketed. Finally, there are 123 SBOs with three or more issues on the same day.

We further identify 15 underwriters that at times, self-marketed their own bond issues and at other times, delegated the process to others. There are 217 cases of such self-marketed and 76 non-self-marketed SBOs. To create the control groups, we also collect data on non-financial offerings. After applying the previous data screening procedures, the non-financial sample contains 3,541 investment-grade offerings by 480 firms.

B. Calculation of Underpricing (Adjusted Discount)

Following most of the existing studies on security offerings, we measure bond underpricing as the percentage difference between the offer price and the immediate post-offer secondary market price. Specifically, the raw (unadjusted) underpricing of bond issue i, $\text{DISCOUNT}_{i,t}$, is measured as the initial return from the offer price, $P_{i,o}$, to the average trade price on the post-offer day of trading t, $P_{i,t}$:

$$\text{DISCOUNT}_{i,t} = \frac{P_{i,t} - P_{i,o}}{P_{i,o}} \times 100\%, \tag{1}$$

where $P_{i,t}$ is the average trade price of bond issue i on post-offer trading day t. The average trade price is calculated as a trade-size weighted average of individual trade prices.[10] We use an average trade price instead of the closing price used in equity

[9] Since our sampling method strictly follows Cai et al. (2007), MTNs are also included our analysis if these offerings meet our filtering criteria. Out of 1,666 bond offerings in our final sample, 535 are MTNs and of which, 256 are self-marketed.

[10] We repeated all the analyses using equal-weighted average prices and found larger underpricing. This reinforces our conclusion that corporate bond offers tend to be underpriced.

offering studies because corporate bonds are thinly traded and have a large bid–ask bounce (Bessembinder et al. (2009)). In this study, we report results using the average trade price on the second post-offer day of trading.[11]

Following Cai et al. (2007), we control for price changes due to market movements between the day the offer price is set and the post-offer trade prices. We calculate the excess return of the individual bond over the return on a bond index of the same rating class during the same period. We use Bank of America Merrill Lynch Corporate Indices as benchmarks, and these indices are categorized by bond ratings (AAA, AA, A, BBB, BB, B, and C). Benchmark returns (BRET) are calculated as percentage changes in the index level from the day the offer price is set $\text{INDEX}_{i,0}$ to the post-offer day of trading $\text{INDEX}_{i,t}$:[12]

$$\text{BRET}_{i,t} = \frac{\text{INDEX}_{i,t} - \text{INDEX}_{i,0}}{\text{INDEX}_{i,0}} \times 100\%. \tag{2}$$

The adjusted discount that accounts for bond market movements is then calculated by subtracting from the raw discount the same period benchmark return:

$$\text{ADJUSTED\_DISCOUNT}_{i,t} = \text{DISCOUNT}_{i,t} - \text{BRET}_{i,t}. \tag{3}$$

The key variable in this study is the ADJUSTED_DISCOUNT, which we use as a measure of the magnitude of underpricing.

C. Sample Summary Statistics

Table 1 provides summary information for all the bond offerings by maturity, rating category, and issue year. We can see from Table 1 that most non-financial offerings are in the A-rated and Baa-rated categories and most financial offerings are A-rated or above. It can also be seen that SBOs generally have a maturity of less than 10 years. For our sample, there are more SBOs after the 2008 financial crisis period. The distributions of numbers of SBOs per year are similar across the three samples.

Table 2 reports detailed issue characteristics and summary statistics. We report the statistics for self-marketed, non-self-marketed financial, and non-financial SBOs. The average offer amount raised by self-marketed issues is $1.335 billion and the median is $1.25 billion. This is much larger than both the average non-self-marketed financial and non-financial SBOs' offer size. The average offer sizes of these SBOs are $734 and $771 million, respectively. It is not surprising that the dollar amount of pre-offer bonds outstanding for self-marketed financial firms, at

[11]Goh et al. (2020) finds that the full extent of underpricing is not captured by measuring the price change from the offer prices to the first-day trade prices. Moreover, the number of trades of an average bond on the second day is larger than that on the first day, which should reduce noise in estimating returns. In un-tabulated results, we also measure bond underpricing using the trade prices on the third day or at the end of the first week of trading, but find the estimated underpricing is similar to that estimated using the second-day prices.

[12]Since we calculate the adjusted discount by subtracting from the raw discount the same period benchmark return, it is important to accurately identify the offer pricing date to ensure we are using the correct $\text{INDEX}_{i,0}$. We verify the SDC pricing dates against various newswire services on Factiva to make sure the date the offer price is set coincides with the earliest date when the pricing information of the offer is announced. We thus corrected 98 SDC pricing dates.

TABLE 1

Distributions of Bond Offerings

Table 1 reports number of observations by maturity, rating category, and issuing year for 1,666 seasoned bond offerings (SBOs) by 138 financial firms and 3,541 issued by 480 non-financial firms from Feb. 2005 to Dec. 2017 that meet the sample restrictions described in Section II. Self-marketed refers to bond issues where the issuer lead–manage its own bond offerings and non-self-marketed issues are bond issues managed by other banks. Moody's rating is used if it is available; otherwise, Standard & Poor's or Fitch rating is adopted.

	Financial (N = 1,666)		Non-Financial (N = 3,541)
	Self-Marketed (N = 710)	Non-Self-Marketed Financial (N = 956)	
By Maturity			
1 ≤ years to maturity ≤ 5	408	444	1,047
5 < years to maturity ≤ 10	218	369	1,588
Years to maturity > 10	84	143	906
By Rating			
Aaa	0	30	85
Aa	165	141	165
A	391	444	391
Baa	154	341	154
By Issuing Year			
2005	25	46	82
2006	33	59	122
2007	37	53	192
2008	22	30	182
2009	26	63	301
2010	58	82	259
2011	41	68	299
2012	49	99	371
2013	72	78	327
2014	80	83	319
2015	98	110	388
2016	107	90	343
2017	62	95	356

TABLE 2

Summary Statistics for Bond Offerings

Table 2 reports summary statistics for 1,666 seasoned bond offerings (SBOs) issued by 138 financial firms, of which 710 are self-marketed offerings, 956 are non-self-marketed, as well as 3,541 SBOs issued by 480 non-financial firms from Feb. 2005 to Dec. 2017 that meet the sample restrictions described in Section II. Self-marketed refers to bond issues where the issuer lead–manage its own bond offerings and non-self-marketed issues are bond issues managed by other banks. OFFER_SIZE equals the offer price times the number of bonds issued. OFFER_PRICE is expressed as a percentage of the face value of a bond issue. PRE_OFFER_BONDS is an issuer's total bonds outstanding in dollar amount as of the day prior to the offer date. DAYS_FROM_PRICING is the number of days between the pricing date and the offer date. TOTAL_ASSETS and MARKET_CAP are the total assets and market capitalization of the issuer at the end of fiscal year before the offering. NUM_BONDS is the number of outstanding bond issues of the issuer as of the day prior to the offer date.

	Self-Marketed (N = 710)		Non-Self-Marketed Financial (N = 956)		Non-Financial (N = 3,541)	
Variable	Mean	Median	Mean	Median	Mean	Median
OFFER_SIZE (000,000 s)	1,334.74	1,250.00	733.89	600.00	770.58	600.00
MATURITY (years)	7.65	5.00	9.63	7.00	12.18	10.00
OFFER_PRICE (percentage)	99.82	99.88	99.70	99.84	99.61	99.75
PRE_OFFER_BONDS (000,000 s)	27,145.00	15,200.00	18,494.00	4,800.00	11,721.00	4,520.00
DAYS_FROM_PRICING	0.15	0.00	0.27	0.00	0.18	0.00
TOTAL_ASSETS (000,000 s)	1,191,834.00	1,019,248.00	218,949.00	116,135.00	67,423.00	30,879.00
MARKET_CAP (000,000 s)	97,219.00	70,220.00	60,752.00	32,478.00	72,887.00	32,515.00
NUM_BONDS	76.11	28.00	15.53	9.00	18.03	9.00
GROSS_SPREAD (percentage)	0.41	0.32	0.35	0.31	0.56	0.60

$27 billion are much higher than non-self-marketed financial or non-financial offerings at $18 and $11 billion, respectively. The average number of outstanding bond issues for self-marketed issuers is 76 and the median is 28. In contrast, the average and median number of outstanding bond issues is 16 and 9 for non-self-marketed financial issuers, and 18 and 9 for non-financial issuers. Following Corwin (2003), the offer date is identified as the first day that the new bond issue is traded. From Table 2, the average days from pricing to offer is 0.15, 0.27, and 0.18 day for the self-marketed, non-self-marketed financial, and non-financial SBOs, respectively. The median is 0 day across these three samples. This suggests that the pricing and offer completion are on the same day, regardless of whether they are self-marketed or non-self-marketed deals. One explanation could be that the SBOs analyzed in this article are all plain vanilla bonds.

Given the differences in key characteristics between self-marketed offerings (treatment group) and the financial non-self-marketed and non-financial offerings (control groups). We fine-tune our matching criteria to make the treatment and control groups more comparable. We do so by restricting our control groups to SBOs with similar credit rating, maturity, issuer's number of outstanding bond issues, and issuer's total asset as the self-marketed offerings. We also create another set of control groups of SBOs with similar credit rating, maturity, and offer size. Perhaps, the cleanest sample to facilitate the test of our agency hypothesis is a unique sample of bonds offerings that are issued by banks that sometimes self-market and sometimes do not self-market their own bonds. Summary statistics for this sample of SBOs are reported in Table 3.

The 15 banks in Table 3 collectively have 217 self-marketed and 76 non-self-marketed SBOs. Examples of such financial firms include large universal banks such as BB&T Corp, U.S. Bancorp, the Bank of New York Mellon, and Wells Fargo. In Appendix A, we show the listing of underwriters that in addition to marketing their corporate clients' bonds, sometimes do and sometimes do not self-market their own bonds. In the same table, we also list the names of underwriters that in addition to

TABLE 3

Summary Statistics for Bond Offerings by Banks That at Times Self-Market and at Times Do Not

Table 3 reports issue level summary statistics for SBOs from Feb. 2005 to Dec. 2017 by financial firms that at times self-market and at times do not self-market. Self-marketed refers to bond issues where the issuer lead–manage its own bond offerings and non-self-marketed are bond issues managed by other banks. OFFER_PRICE is expressed as a percentage of the face value of a bond issue. DAYS_FROM_PRICING is the number of days between the pricing date and the offer date. The significance level of the means (medians) is based on a *t*-test (Wilcoxon signed-rank test). The difference in means *t*-statistic assumes unequal variances across groups when a test of equal variances is rejected at the 10% level. The significance level of the difference in medians is based on a Wilcoxon rank-sum test. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. A listing of these underwriters are reported in Appendix A.

	Non-Self-Marketed Offerings (N = 76)		Self-Marketed Offerings (N = 217)		Differences	
Variable	Mean	Median	Mean	Median	Mean	Median
OFFER_SIZE (000,000 s)	749.33	600.00	1,102.65	1,000.00	−353.32***	−400.00***
MATURITY (years)	6.20	5.00	6.49	5.00	−0.29	0.00
OFFER_PRICE (percentage)	99.38	99.84	99.85	99.89	−0.47*	−0.05*
DAYS_FROM_PRICING	0.34	0.00	0.07	0.00	0.27**	0.00
GROSS_SPREAD (percentage)	0.21	0.15	0.27	0.15	−0.06	0.00

marketing their clients' bonds, issue their own bonds all the time, as well as those that never self-market their own bonds.

From Table 3, the average size of self-marketed SBOs is significantly greater than non-self-marketed SBOs. The median size of self-marketed SBOs is $1 billion while that of non-self-marketed is $600 million. There is no significant difference in the maturity of the SBOs. The median numbers of days from pricing date to offer date for both self- and non-self-marketed bonds is 0 days. From these issue level summary statistics, the self-marketed SBOs are larger in size, suggesting that banks tend to market larger SBOs themselves.

IV. Empirical Findings

A. Underpricing of Self Versus Non-Self Marketed SBOs by the Same Banks

To directly test the agency hypothesis, we study cases in which a bank lead–manages its own bond issues and compare the degree of underpricing of these self-marketed offerings (treatment group) to those offerings that are not self-marketed (control groups). First, we compare underpricing of SBOs by banks that switch between self-marketed and non-self-marketed offerings.

As reported in Table 4, we find that when these banks self-market their own offerings, the average underpricing is only 0.10% and the median is 0.06%. However, when they hire other underwriters to market their SBOs, the average underpricing is 0.27% and the median is 0.10%. The difference in average underpricing between self- and non-self-marketed deals is 0.17% (0.27%–0.10%) and the

TABLE 4

Underpricing of Bond Offerings Issued by Financial Firms That at Times Self-Market and at Times Do Not

Table 4 reports the underpricing of bond issues by financial firms that at times self-market and at times do not self-market, from Feb. 2005 to Dec. 2017. It also reports proportion (%) of negative underpricing (overpriced) deals within each sample. Overpriced deals are bond offerings with post-offer trading price less than offer price. Self-marketed refers to bond offerings when these banks lead–manage their own bond offerings; non-self-marketed refers to bond offerings when these banks do not lead–manage their own bond offerings. Adjusted discount is calculated by subtracting from the raw discount the same period index returns corresponding to the same rating category. Raw discount is measured as the trade-size weighted average price on the second day of trading minus the offer price expressed as a percentage of the offer price. The significance level of the means (medians) is based on a *t*-test (Wilcoxon signed-rank test). The difference in means *t*-statistic assumes unequal variances across groups when a test of equal variances is rejected at the 10% level. The significance level of the difference in medians is based on a Wilcoxon rank-sum test. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. A listing of such financial firms is reported in Appendix A.

Adjusted Discount		*N*	Mean (%)	Median (%)	Proportion of Overprice (%)
(1) SELF_MARKETED		217	0.10**	0.06*	7.37
(2) NON_SELF_MARKETED		76	0.27***	0.10***	5.26
Difference: (2)–(1)			0.17***	0.04***	2.11
By Ratings					
Aa and above	(1) SELF_MARKETED	48	0.07**	0.05**	2.08
	(2) NON_SELF_MARKETED	16	0.15**	0.07**	0.00
	Difference: (2)–(1)		0.08**	0.02**	2.08
A	(1) SELF_MARKETED	139	0.09**	0.06*	9.35
	(2) NON_SELF_MARKETED	36	0.19*	0.08**	8.33
	Difference: (2)–(1)		0.10**	0.02**	1.02
Baa	(1) SELF_MARKETED	30	0.17**	0.07**	6.67
	(2) NON_SELF_MARKETED	24	0.47**	0.26**	4.17
	Difference: (2)–(1)		0.30**	0.19**	2.50

disparity in underpricing is statistically significant at the 1% level. We further partition the sample into three rating categories, Aa and above, A, and Baa. Please note that none of the self-marketed offerings are rated Aaa. For SBOs rated Aa and above, A, and Baa, the differences in underpricing are increasing monotonically at 0.08%, 0.10%, and 0.30%, respectively. These differences in underpricing are all statistically significant at the at the 5% level.

The previous results indicate that lead managers on average price their own deals higher than those of their clients. This would imply higher frequency of trading down (negative underpricing) of self-marketed SBOs on the issue date. We tabulated the proportion in percentages of SBOs that trade down at the end of the first day of trading. From Table 4, for the 217 self-marketed SBOs, 16% or 7.37% of them traded down. The percentage of negative underpricing for self-marketed SBOs is higher than the 76 non-self-marketed deals, of which only 4 out 76, 5.26% traded down on the first day. The difference between the self-marketed and non-self-marketed SBOs is 2.11% but is statistically insignificant at conventional levels.

B. Endogeneity (Self-Selection) Test

One may question the robustness of the previous results, as it is possible that factors that influence the decision to self-market are also correlated with those impacting bond underpricing, thus creating potential self-selection biases. For example, these banks may have private information to time the marketing of their own SBOs (i.e., whether to self-market or to hire other underwriters to market them). Therefore, we perform selection analyses for bonds issued by the banks that switch between self- and non-self-marketed SBOs.

To control for possible endogeneity in the self-marketing decision, we follow Bushee et al. (2003) and adopt a 2-equation selection model.[13] The alternative selection model would be to use the Heckman 2-step methodology. However, Puhani (2000) suggests that in the absence of collinearity problems, the full-information maximum likelihood estimator is preferable to the limited-information 2-step method of Heckman. We check the independent variables used in this analysis for collinearity problems and find that the condition numbers of our variable matrix range from 1 to 7.48. None of the condition numbers exceeds 30, the critical value that warrants further investigation.[14] Hence, collinearity in the explanatory variables is not a concern. Therefore, the preferred selection model is the full-information maximum likelihood estimator approach that is used in Bushee et al. (2003).

Two-equation selection models consist of a treatment equation and a regression equation. Suppose there is an unobservable underlying variable,

[13]Models of this type are discussed in detail by Heckman (1979), Maddala ((1983), pp. 221–256), and Greene ((2000), pp. 896–938). See also Li and Prabhala (2007) and Lennox, Francis, and Wang (2012) for a useful discussion and survey of similar models in corporate finance and accounting research.

[14]Belsley, Kuh, and Welsch's (1980) suggest using 30 as the critical value for the condition number. The condition number of a matrix is defined as the ratio of its largest eigenvalue to its smallest eigenvalue. A singular matrix has a condition number of infinity (worst). The identity matrix has a condition number of 1. The condition number is the most commonly used method to check on the invertibility of the variance–covariance matrix.

SELF_MARKETED*$_i$, that determines whether a financial firm will decide to self-market its own bond issue *i.* If SELF_MARKETED*$_i$ exceeds 0, the bond is self-marketed, otherwise, it is not. Formally, the treatment rule is given by

$$\text{SELF\_MARKETED}_i^* = \gamma' W_i + u_i, \tag{4}$$

$$\text{SELF\_MARKETED}_i = 1 \text{ if } \text{SELF\_MARKETED}_i^* > 0, \quad \text{SELF\_MARKETED}_i = 0 \text{ otherwise}, \tag{5}$$

and

$$\text{Prob}(\text{SELF\_MARKETED}_i = 1) = \Phi(\gamma' W_i). \tag{6}$$

In equations (4)–(6), W_i denotes a column vector containing values for the variables hypothesized to affect the probability that bond *i* is self-marketed. γ' is a row vector of coefficients, and u_i is a disturbance term assumed to be normally distributed with mean 0 and variance 1. $\Phi(\gamma' W_i)$ denotes the cumulative standard normal distribution function evaluated at the point $\gamma' W_i$.

The regression equation relates the variable of primary interest, ADJUSTED_DISCOUNT to the self-marketed dummy variable, SELF_MARKETED$_i$, and to a vector of control variables, X_i. ADJUSTED_DISCOUNT is calculated as the percentage difference between the offer prices to the second-day average trade prices, adjusted by bond market movements. ADJUSTED_DISCOUNT$_i$ denote the measure of underpricing and the regression equation is

$$\text{ADJUSTED\_DISCOUNT}_i = \beta' X_i + \lambda \text{SELF\_MARKETED}_i + e_i. \tag{7}$$

In equation (7), β' is a row vector containing the coefficients of the control variables X_i and λ measures the effect of self-marketing on ADJUSTED_DISCOUNT$_i$. The disturbance term e_i is assumed to be normally distributed with mean 0 and variance σ^2_e, and the correlation between u_i and e_i is denoted by ρ. The parameters of the 2-equation models are estimated simultaneously by the method of maximum likelihood. This methodology jointly estimates the decision to self-market and the effect of self-marketing on bond underpricing. The form of the likelihood function follows from the properties of the truncated bivariate normal distribution (see Greene ((2000), p. 927) Theorem 20.5). This method yields asymptotically efficient estimates. In principle, the approach has an advantage over alternatives such as the Heckman (1979) 2-step estimator, which is consistent but not efficient. Our inferences are based on the asymptotic covariance matrix of the estimated parameters.

C. Control Variables for Self-Selection Test: Known Determinants of Underpricing

One possible explanation for the disparity in underpricing between self- and non-self-marketed offerings may be valuation uncertainty and information asymmetry (Cai et al. (2007)). We control for these effects by using the following proxies. A bond's credit rating (CREDIT_RATING) is a natural proxy because highly rated bonds are typically issued by large and mature firms that have had security offerings

before and therefore have less valuation uncertainty. Moreover, these firms are subjected to closer scrutiny by the market, and as a result, tend to have less information asymmetry. Bond maturity (MATURITY) is another proxy for valuation uncertainty because the price volatility is greater for bonds with a longer maturity. Furthermore, it can be argued that number of outstanding bond issues (NUM_BONDS) may be a worthy proxy for the bank's information set. For example, banks that can underwrite their own bonds may have better market knowledge of when to issue bonds because they are in the market regularly and this knowledge may affect pricing.

We also rely on previous work in formulating additional variables to control for uncertainty and information asymmetry. As suggested by Yeoman (2001), we use bond price volatility (BOND_PRICE_VOL) to proxy for the underwriting syndicate's level of uncertainty concerning the security's actual value. We measure the volatility as the standard deviation of daily bond price changes over the 1-month period after the offer. As Corwin (2003) points out, the longer the time span, the more likely market conditions will change before the offer completion and, therefore, more uncertainty. Thus, we include the days from pricing to offer date (DAYS_FROM_PRICING) variable to capture this possibility. Frankel, Kothari, and Weber (2006) argue that security analysts amalgamate and distill private information in a manner that reduces information asymmetry. Accordingly, we include analyst coverage (ANALYST_COVERAGE) as a control. Following Frankel et al. (2006), we define ANALYST_COVERAGE as the number of analysts following the issuing firm. Valuation uncertainty of an issue may be affected by market-wide uncertainty. To control for this, we use two measures, the VIX index to measure expected stock market volatility and the MOVE index to capture expected interest rate risk. The VIX index is the Chicago Board Options Exchange (CBOE) measure of the implied volatility of S&P 500 index options. The MOVE index is developed by Merrill Lynch to measure the implied volatility of U.S. Treasury bonds and is essentially the interest rate equivalent of the VIX. Higher levels of these indexes indicate higher market uncertainty.

To control for the potential effect of aftermarket illiquidity on pricing, we use variables proposed by Ellul and Pagano (2006). Specifically, we use the monthly post-offer bid–ask spreads (BID_ASK) as an explanatory variable in the regression. We first calculate the daily bid–ask effective half-spread as

$$\text{BID\_ASK}_{i,t} = \frac{p_{\text{ASK},i,t} - p_{\text{BID},i,t}}{p_{\text{ASK},i,t} + p_{\text{BID},i,t}}, \tag{8}$$

where $p_{\text{ASK},i,t}$ is the weighted average of prices from all customer buys (at ask prices) for bond i on day t, and $p_{\text{BID},i,t}$ is the weighted average of prices from all customer sells (at bid prices) for bond i on day t. This daily measure is then averaged over the first month after the offer to get the monthly bid–ask spreads. A higher bid–ask spread implies higher aftermarket illiquidity. We also include the bid–ask volatility (BID_ASK_VOL) to capture possible liquidity risk, which is suggested by Ellul and Pagano (2006).

In addition to using a set of explanatory variables suggested by previous studies, we also include a YEAR_2009 dummy designating issues offered between

Oct. 2008 and Oct. 2009, when bank-issued debts were possibly covered by FDIC's debt guarantee program. Given the popularity and possible pricing differences in shelf-registered offerings, we also include a SHELF_REGISTRATION dummy, which equals 1 if the offering is through a shelf registration. Finally, it is possible that size and the complexity of the issue might drive the decision to self-market and the eventual underpricing of the offerings. We use OFFER_SIZE which is calculated as the offer price times the number of bonds issued to proxy for the size and complexity of the offering.[15] We also use an indicator variable, RATING_DISAGREEMENT for SBOs that are rated differently by different rating agencies. It is possible that the split ratings from these agencies arise from the complexity of the deal. We adopt these variables as our controls in the selection and regression models.[16]

Panel A of Table 5 reports the estimates for the treatment equations and Panel B reports the effect of the decision to self-market on bond underpricing. The results from Panel B confirm the findings reported in Table 4. That is, self-marketed bond issues are significantly less underpriced than non-self-marketed offerings. Specifically, the expected bond underpricing is 0.15% lower for self-marketed offerings, and statistically significant at 10% level. These results show that after considering the possible self-selection bias, the estimated difference in underpricing arising from the decision to self-market is still significant and similar in magnitude to those estimated in Table 4. Recall from Table 4, the disparity in the simple average underpricing between self- and non-self-marketed SBOs by the same banks is 0.17% (0.27%–0.10%).

We also test the hypothesis that ρ, the correlation between the disturbance terms in the treatment and regression equations, equals 0. The appropriate statistic for a test of this restriction is asymptotically distributed as a chi-square variable with 1 degree of freedom. The point estimate of ρ is 0.17 and the chi-square value is 0.89 (p-value = 0.34). These results suggest that the endogeneity problem due to selection associated with single equation regression methods in our current research application is not a major concern.

In summary, banks' SBOs experience significantly less underpricing when they lead–manage their own offerings. The result is robust after controlling for observable bond characteristics, market conditions, and possible endogeneity in self-marketing decisions. Taken together, the univariate and selection model results suggest the agency conflict-of-interest is a plausible explanation for the underpricing of corporate bond offerings.

D. Robustness Tests of the Disparity in Bond Underpricing: Univariate Tests

To assess the robustness of our finding of significant disparity in underpricing between self-marketed versus non-self-marketed SBOs by the same banks, we conduct the following tests. We compare all the 710 self-marketed offerings with

[15]We thank the reviewer for the insight and suggestion of this variable.

[16]For the sake of brevity, we describe other known determinants used in previous studies in Appendix B in detail.

TABLE 5

Estimates for 2-Equation Treatment Models for Offerings Issued by Financial Firms That at Times Self-Market and at Times Do Not

Table 5 reports the results for the 2-equation treatment model for investment-grade financial seasoned bond issues from Feb. 2005 to Dec. 2017. We use offerings by firms that sometimes self-market and sometimes not. The parameters of the 2-equation models are estimated simultaneously by the method of maximum likelihood, so that this analysis jointly estimates the decision to self-market and the effect of self-marketing on bond underpricing. Panel A presents the first equation estimation results for the self-marketing decision. The dependent variable is a binary variable that equals 1 if the issuer lead–manages its own bond offering, and 0 otherwise. Panel B reports the second regression results of the effect of self-marketed on the magnitude of bond underpricing. The dependent variable is ADJUSTED_DISCOUNT, calculated by subtracting from the raw discount the same period index return corresponding to the same rating category, where raw discount is measured as the trade-size weighted average trade price on the second post-offer day of trading minus the offer price expressed as a percentage of the offer price. The omitted category in the first and second regressions includes issues rated as Aa and above with a maturity of 5 years or less. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. Definitions of each variable are provided in Appendix B.

	Estimate		*t*-Value
Panel A. First Equation – Decision to Self-Market			
INTERCEPT	−1.8328		−0.53
log(NUM_BONDS)	0.1296		1.11
TOTAL_ASSETS	0.3423		1.50
SHELF_REGISTRATION	−0.4182		−1.59
A	0.0693		0.19
Baa	−0.0555		−0.11
5_10_YEARS	0.2603		0.86
>10_YEARS	2.6757**		2.47
CALL_OPTION	0.7673***		2.76
RATING_DISAGREEMENT	0.5682**		2.42
BOND_PRICE_VOL	−0.3891		−0.43
DAYS_FROM_PRICING	0.0077		0.02
ANALYST_COVERAGE	−0.1164		−1.20
MOVE	−1.8330***		−2.59
VIX	0.4161		0.66
OFFER_SIZE	0.6154**		2.14
BID_ASK	1.3896		0.93
BID_ASK_VOL	−0.0874		−0.07
YEAR_2009	0.6735		1.18
Panel B. Second Equation – The Effect of Self-Marketing on Underpricing			
INTERCEPT	0.6142		1.34
SELF_MARKETED	−0.1459*		−1.73
log(NUM_BONDS)	−0.0012		−0.07
TOTAL_ASSETS	−0.0125		−0.38
SHELF_REGISTRATION	−0.0143		−0.36
A	−0.0048		−0.11
Baa	0.0598		0.86
5_10_YEARS	0.0050		0.13
>10_YEARS	−0.0451		−0.52
CALL_OPTION	−0.0522		−1.29
RATING_DISAGREEMENT	−0.0584*		−1.71
BOND_PRICE_VOL	0.3347***		2.87
DAYS_FROM_PRICING	−0.2183***		−3.35
ANALYST_COVERAGE	−0.0015		0.01
MOVE	−0.0098		−0.09
VIX	−0.1057		−1.18
OFFER_SIZE	0.0161		0.38
BID_ASK	0.7544***		3.23
BID_ASK_VOL	−0.7800***		−3.89
YEAR_2009	−0.1713*		−1.84
No. of obs.		293	
Wald statistic		113.92 ($P < 0.0001$)	
Rho		0.1713	
$\chi 2$		0.89 ($P = 0.3444$)	

5 different control samples of non-self-marketed offerings. Control Group 1 consists of all 956 non-self-marketed offerings issued by financial firms. Group 2 are financial non-self-marketed offerings matched by credit rating, maturity, issuer's total assets, and the number of outstanding bond issues. Group 3 are financial non-self-marketed

TABLE 6

Underpricing of Self-Marketed Versus Non-Self-Marketed Bond Offerings

Table 6 reports the underpricing of investment-grade seasoned bond issues from Feb. 2005 to Dec. 2017. It also reports proportion (%) of negative underpricing (overpriced) deals within each sample. Overpriced deals are bond offerings with post-offer trading price less than offer price. SELF_MARKETED refers to bond offerings when banks lead–manage their own bond offerings; non-self-marketed financial refers to financial firms' bond offerings managed by other banks. Matched non-self-marketed financial (TA_NB) refers to non-self-marketed financial firms' offerings that have the same rating and maturity category and that the issuer has the smallest percentage difference in the number of outstanding bond issues and total assets with the self-marketed offerings. Matched non-self-marketed financial (OFFER) refers to non-self-marketed financial firms' bond offerings that have the same rating and maturity category and smallest percentage difference in offer size with the self-marketed offerings. Matched non-financial (TA_NB) refers to non-financial firms' bond offerings (naturally they are all non-self-marketed) that have the same rating and maturity category and that the issuer has the smallest percentage difference in the number of outstanding bond issues and total assets with the self-marketed offerings. Matched non-financial (OFFER) refers to non-financial firms' bond offerings (naturally they are all non-self-marketed) that have the same rating and maturity category and smallest percentage difference in offer size with the self-marketed offerings. The significance level of the means (medians) is based on a *t*-test (Wilcoxon signed-rank test). The difference in means *t*-statistic assumes unequal variances across groups when a test of equal variances is rejected at the 10% level. The significance level of the difference in medians is based on a Wilcoxon rank-sum test. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Variable: ADJUSTED_DISCOUNT	*N*	Mean (%)	Median (%)	Proportion of Overprice (%)
SELF_MARKETED	710	0.15***	0.12***	31.13
Control Groups				
(1) Non-self-marketed financial	956	0.34***	0.20***	24.26
(2) Matched non-self-marketed financial (TA_NB)	710	0.26***	0.18***	23.38
(3) Matched non-self-marketed financial (OFFER)	710	0.34***	0.21***	23.38
(4) Matched non-financial (TA_NB)	710	0.32***	0.22***	11.97
(5) Matched non-financial (OFFER)	710	0.38***	0.25***	21.12
Disparity in Underpricing Between Non-Self-Marketed and Self-Marketed SBOs				
Group 1 – SELF_MARKETED		0.19***	0.08***	6.87***
Group 2 – SELF_MARKETED		0.11***	0.06***	7.75***
Group 3 – SELF_MARKETED		0.19***	0.09***	7.75***
Group 4 – SELF_MARKETED		0.17***	0.10***	19.16***
Group 5 – SELF_MARKETED		0.23***	0.13***	10.01***

offerings matched by credit rating, maturity, and offer size. Group 4 are offerings issued by non-financial firms matched by credit rating, maturity, issuer's total assets, and the number of outstanding bond issues. Group 5 are offerings issued by non-financial firms matched by credit rating, maturity, and offer size.

From Table 6, the mean adjusted discount is 0.15% for the 710 self-marketed SBOs and 0.34% for the 956 non-self-marketed financial SBOs (Group 1). Both are statistically significant at the 1% level. The difference in their underpricing is 0.19% and it is statistically significant at the 1% level.[17] The mean underpricing for the matched non-self-marketed financial (Group 2) and non-financial (Group 4) offerings are 0.26% and 0.32%, respectively. The disparity in underpricing between these matched control groups and self-marketed SBOs are 0.11% and 0.17%, respectively. They are both statistically significant at the 1% level. We also compare underpricing between self-marketed SBOs with financial and non-financial control groups matched by credit rating, maturity, and offer size. We find the disparities in underpricing between the self-marketed SBOs and Groups 3 and 5 are higher, at 0.19% and 0.23%, respectively. These disparities are also statistically significant at the 1% level.

[17]We find the average underpricing for self-marketed with solo bookrunners is 0.19% (median = 0.13%), whereas the average underpricing for self-marketed with multiple bookrunners is 0.12% (median = 0.11%), and the difference is statistically insignificant at conventional levels.

As in Table 4, we also tabulated the proportion in percentages of SBOs that trade down at the end of the first day of trading for our full SBO sample. From Table 6, of the 710 self-marketed SBOs, 221 or 31.13% of them traded down. For the 956 non-self-marketed SBOs, 232 or 24.26% traded down at the close of the first day of trading. More interesting are the results from the matched non-financial sample where the incidences of overpricing are 11.97% and 21.12%. The differences in the percentage of SBOs that traded down between self-marketed and the matched non-financial SBOs are 19.16% and 10.01%, and they are statistically significant at the 1% level. These results support our views that lead managers tend to price their own deals tighter.

Next, we compare underpricing between self-marketed SBOs and the 5 control groups of non-self-marketed SBOs for the Aa and above, A, and Baa rating categories. These results are summarized in Table 7. We can see from Table 7 that within each rating category, self-marketed offerings are significantly less underpriced than all 5 control groups of non-self-marketed SBOs. Self-marketed SBOs in the Aa and above, A, and Baa rating categories are on average underpriced by 0.09%, 0.14%, and 0.19%, respectively. The disparity in underpricing between self-marketed and the 5 control groups of non-self-marketed SBOs in the Aa and above rated bonds ranges from 0.04% to 0.21%. As we move toward the A and Baa categories, the disparities in underpricing increase monotonically. In the A-rated category, the disparity ranges between 0.09% and 0.20% and for the Baa-rated category, the range is between 0.21% and 0.38%. The disparities in underpricing between self- and non-self-marketed SBOs are all statistically significant at the 1% level.

In brief, our univariate analyses show that when banks lead–manage their own SBOs, the underpricing is significantly lower than those of their clients. Recall from Table 6, the magnitude of the disparity in underpricing between self-marketed and matched non-self-marketed offerings range from 0.11% to 0.23%. In addition to statistical significance, our findings also have major financial implications. The economic significance stemming from the disparity in underpricing is nontrivial given that the total non-self-marketed investment-grade bond offerings amounted to over a trillion dollars per year.

E. Robustness Tests of the Disparity in Bond Underpricing: Regression Tests

To verify the robustness of univariate results, we conduct multiple regression analyses to determine whether underpricing disparity between self- and non-self-marketed SBOs continue to exist after controlling for known determinants of bond underpricing. Results from Tables 6 and 7, showing significant underpricing disparity between self-marketed and non-self-marketed SBOs, support our main findings that agency costs are manifesting themselves in the bond issuance process. However, in addition to agency-based explanations, there is a broad theoretical literature on security offering underpricing. Accordingly, we further examine whether the disparity in underpricing between self-marketed and non-self-marketed SBOs still exists after controlling for alternative explanations. We conduct multiple regressions analyses for the sample of 1,666 SBOs by financial firms with

TABLE 7

Underpricing of Self-Marketed Versus Matched Non-Self-Marketed Bond Offerings

Table 7 reports the underpricing of investment-grade seasoned bond issues by from Feb. 2005 to Dec. 2017, by ratings. It also reports proportion (%) of negative underpricing (overpriced) deals within each sample. Overpriced deals are bond offerings with post-offer trading price less than offer price. SELF_MARKETED refers to bond offerings when banks lead–manage their own bond offerings; non-self-marketed financial refers to financial firms' bond offerings managed by other banks. Matched non-self-marketed financial (TA_NB) refers to non-self-marketed financial firms' offerings that have the same rating and maturity category and that the issuer has the smallest percentage difference in the number of outstanding bond issues and total assets with the self-marketed offerings. Matched non-self-marketed financial (OFFER) refers to non-self-marketed financial firms' bond offerings that have the same rating and maturity category and smallest percentage difference in offer size with the self-marketed offerings. Matched non-financial (TA_NB) refers to non-financial firms' bond offerings (naturally they are all non-self-marketed) that have the same rating and maturity category and that the issuer has the smallest percentage difference in the number of outstanding bond issues and total assets with the self-marketed offerings. Matched non-financial (OFFER) refers to non-financial firms' bond offerings (naturally they are all non-self-marketed) that have the same rating and maturity category and smallest percentage difference in offer size with the self-marketed offerings. The significance level of the means (medians) is based on a *t*-test (Wilcoxon signed-rank test). The difference in means *t*-statistic assumes unequal variances across groups when a test of equal variances is rejected at the 10% level. The significance level of the difference in medians is based on a Wilcoxon rank-sum test. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Rating	Sample	Mean (%)	Median (%)	Proportion of Overprice (%)
Aa and above	SELF_MARKETED (N = 165)	0.09**	0.08***	35.75
	Control Groups			
	(1) Non-self-marketed financial (N = 183)	0.19***	0.13***	27.32
	(2) Matched non-self-marketed financial (TA_NB)	0.13***	0.12***	22.42
	(3) Matched non-self-marketed financial (OFFER)	0.21***	0.17***	26.06
	(4) Matched non-financial (TA_NB)	0.24***	0.22***	10.91
	(5) Matched non-financial (OFFER)	0.30***	0.21***	19.39
	Disparity in Underpricing Between Non-Self-Marketed and Self-Marketed SBOs:			
	Group 1 − SELF_MARKETED	0.10***	0.05***	8.43*
	Group 2 − SELF_MARKETED	0.04***	0.04**	13.33***
	Group 3 − SELF_MARKETED	0.12***	0.09***	9.69*
	Group 4 − SELF_MARKETED	0.15***	0.14***	24.84***
	Group 5 − SELF_MARKETED	0.21***	0.13***	16.36***
A	SELF_MARKETED (N = 391)	0.14***	0.12***	32.22
	Control Groups			
	(1) Non-self-marketed financial (N = 446)	0.33***	0.19***	22.87
	(2) Matched non-self-marketed financial (TA_NB)	0.23***	0.19***	24.55
	(3) Matched non-self-marketed financial (OFFER)	0.30***	0.20***	22.51
	(4) Matched non-financial (TA_NB)	0.32***	0.22***	12.28
	(5) Matched non-financial (OFFER)	0.34***	0.23***	23.53
	Disparity in Underpricing Between Non-Self-Marketed and Self-Marketed SBOs:			
	Group 1 − SELF_MARKETED	0.19***	0.07***	9.35***
	Group 2 − SELF_MARKETED	0.09***	0.07**	7.67**
	Group 3 − SELF_MARKETED	0.16***	0.08***	9.71***
	Group 4 − SELF_MARKETED	0.18***	0.10***	19.94***
	Group 5 − SELF_MARKETED	0.20***	0.11***	8.69***
Baa	SELF_MARKETED (N = 154)	0.19***	0.19***	23.38
	Control Groups			
	(1) Non-self-marketed financial (N = 327)	0.45***	0.28***	24.46
	(2) Matched non-self-marketed financial (TA_NB)	0.43***	0.44***	21.43
	(3) Matched non-self-marketed financial (OFFER)	0.40***	0.23***	22.73
	(4) Matched non-financial (TA_NB)	0.57***	0.31***	12.34
	(5) Matched non-financial (OFFER)	0.52***	0.34***	16.88
	Disparity in Underpricing Between Non-Self-Marketed and Self-Marketed SBOs:			
	Group 1 − SELF_MARKETED	0.26***	0.09***	−1.08
	Group 2 − SELF_MARKETED	0.24***	0.25**	1.95
	Group 3 − SELF_MARKETED	0.21***	0.04***	0.65
	Group 4 − SELF_MARKETED	0.38***	0.12***	11.04***
	Group 5 − SELF_MARKETED	0.33***	0.15***	6.50

ADJUSTED_DISCOUNT as the dependent variable. Our key variable of interest to test the agency hypothesis is the SELF_MARKETED dummy, which takes the value of 1 if a bank lead–manages its own bond issue, and 0 otherwise. The control variables are the same as those used in our selection model from Table 5. For robustness checks on our regression analyses, we also control for year and underwriter fixed effects.

It is well-known that firms can have multiple bond issues with different maturities on the same day. In our full sample of 1,666 SBOs, 552 of these SBOs have 2 and 123 have 3 or more bonds with different maturities being issued on the same day by the same firm. This clustering of 2 or more observations by the same firm on the same day could potentially affect the variance structure of the error terms. Peterson (2009) shows that of the most common approaches used in the literature to address this matter, only clustered standard errors are unbiased as they account for the residual dependence created by the firm effect. To correct for the occurrence of multiple tranches in bond offerings, the test statistics are computed using firm-date clustered standard errors.[18] We also report test statistics using White's heteroscedasticity consistent standard errors.

Model 1 is the baseline specification, model 2 introduces the year fixed effects, and in model 3, we include both year and underwriter fixed effects. The regression results are presented in Table 8. The omitted category is bond issues rated Aa or better with a maturity of 5 years or less. We can see from all the regression models, Baa rating, MATURITY, log(NUM_BONDS), ANALYST_COVERAGE, BID_ASK_VOL, and MOVE indices are significant determinants of underpricing for the entire sample. BOND_PRICE_VOL is positive and statistically significant at the 5% and 1% level for model 2 and 3, respectively. Estimated coefficients from DAYS_FROM_PRICING are generally negative and significant at the 1% level for model 2 only. The coefficients for OFFER_SIZE are statistically insignificant at conventional confidence level for all models. These findings are consistent with Cai et al. (2007) who find that offer size does not affect bond underpricing.

As can be seen in models 1–3 of Table 8, the estimated coefficients for our variable of interest, the SELF_MARKETED dummy, are −0.0937, −0.0894, and −0.0890, respectively. The *t*-value using firm-date clustered correction are all statistically significance at the 5% level.[19] These results imply that the estimated difference in underpricing between non-self-marketed and self-marketed SBOs after controlling for other known determinants ranges between 0.089% and 0.094%. This finding is comparable to those shown in Table 6 where the disparity in underpricing without controls ranges between 0.11% and 0.23%. Results from Table 8 reinforce our hypothesis that other known determinants of underpricing, such as price uncertainty and information asymmetry, can explain part, but not all the underpricing difference between self-marketed and non-self-marketed SBOs.

[18]We test several alternative specifications, including OLS standard errors, year, and issuer clustered standard errors, and obtain qualitatively similar results.

[19]We introduce a dummy variable MTN indicating medium term note offerings in our regression analysis. In untabulated results, with the MTN control, the key variable SELF_MARKETED remain statistically significant at the 5% level for all 3 specifications.

TABLE 8

Regression Analysis of Underpricing of Self-Marketed Bond Offerings

Table 8 reports the results from regressions models 1–3 of investment-grade seasoned bond issues by all financial firms from Feb. 2005 to Dec. 2017. The dependent variable is ADJUSTED_DISCOUNT, calculated by subtracting from the raw discount the same period index return corresponding to the similar rating category, where raw discount is measured as the trade-size weighted average trade price on the second post-offer day of trading minus the offer price expressed as a percentage of the offer price. The main independent variable of interest is SELF_MARKETED, which equals 1 if the issuer acts as lead manager of its own bond offering. The omitted category includes issues rated as Aa and above with a maturity of 5 years or less. *T* (White) is calculated from White's heteroscedasticity consistent standard errors, and *T* (clustered) is calculated from issuing firm-date clustered standard errors. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. Detailed definitions of each variable are provided in Appendix B.

	Model						
	1			2		3	
	Estimate	*t* (Clustered)	*t* (White)	Estimate	*t*	Estimate	*t*
INTERCEPT	−0.1424	−1.37	−1.62				
SELF_MARKETED	−0.0937**	−2.29	−2.69	−0.0894**	−2.54	−0.0890**	−2.12
log(NUM_BONDS)	−0.0263***	−2.83	−3.24	−0.0237***	−2.74	−0.0231**	−2.33
TOTAL_ASSETS	0.0238	0.73	0.80	0.0199	0.70	−0.0056	−0.16
SHELF_REGISTRATION	0.0368	1.22	1.43	−0.0044	−0.12	0.0460	1.21
A	0.0512	1.57	1.79	0.0545	1.54	0.0771*	1.91
Baa	0.1586***	3.48	3.85	0.1671***	3.98	0.2114***	4.60
5_10_YEARS	0.1049***	2.86	2.84	0.1078***	3.47	0.1010***	3.15
>10_YEARS	0.2990***	3.84	3.96	0.3041***	6.26	0.2717***	5.42
CALL_OPTION	−0.0181	−0.56	−0.66	0.0174	0.51	−0.0026	−0.07
RATING_DISAGREEMENT	−0.0119	−0.38	−0.43	−0.0200	−0.73	−0.0291	−0.98
BOND_PRICE_VOL	0.1273	1.17	1.16	0.1334**	2.12	0.2051***	3.10
DAYS_FROM_PRICING	−0.0502	−1.50	−1.68	−0.0473***	−3.11	−0.0252	−1.57
ANALYST_COVERAGE	−0.0034**	−2.36	−2.67	−0.0034**	−2.41	−0.0028*	−1.78
MOVE	0.0029*	1.90	2.24	0.0036***	3.24	0.0026**	2.24
VIX	0.0097*	1.85	2.13	0.0042	1.10	0.0034	0.82
OFFER_SIZE	0.0090	0.31	0.33	0.0115	0.46	0.0162	0.61
BID_ASK	0.2441	0.90	0.94	0.1105	0.74	0.0199	0.13
BID_ASK_VOL	−0.4718**	−2.27	−2.25	−0.4392***	−3.84	−0.5050***	−4.28
YEAR_2009	0.1723	1.04	1.19				
Year fixed	No			Yes		Yes	
Lead manager fixed	No			No		Yes	
R^2	0.1676			0.1864		0.3762	

These results lend support to the conflict-of-interest hypothesis as a partial explanation for the underpricing of corporate bond offerings.

V. Conclusion

In this article, we confirm that corporate bond offerings are systematically underpriced. We find significant underpricing for both non-financial and financial investment-grade SBOs. For non-financial investment-grade SBO, underpricing averages 38 basis points, amounting to a cost of over $2.28 million per average transaction. Since a corporate bond typically matures in 10 years and assuming a bond issuer does not change its capital or debt structure substantially, periodically refinancing these bonds will result in substantial repeated losses of proceeds. These losses represent a transfer of wealth from issuing firm shareholders to new bond investors.

We investigate whether this transfer of wealth is the artifact of the existence of conflict of interest between underwriters and issuers. We find that when banks lead–manage their own bond offerings, the average underpricing of these self-marketed offerings is significantly lower, suggesting that the agency conflict-of-interest

problem may be a plausible explanation. Hence, we conclude that it is possible that shareholders of corporations may have been short-changed when they issue bonds.

Appendix A. Underwriting Banks that Issue Corporate Bonds

Appendix A lists the underwriting banks that issue SBOs and serve as lead managers of at least 1 bond issue in our sample.

A.1. Banks that in Addition to Marketing Clients' Corporate Bonds, Sometimes Self-Marketed Their Own Bonds and at Other Times, Delegated Their Bond Issues to Other Underwriters

1. BB&T Corp
2. Bank of New York Mellon Corp
3. Bank of Nova Scotia
4. U.S. Bancorp
5. Wells Fargo & Co
6. Zions Bancorp
7. Raymond James Financial Inc.
8. Bank of Montreal
9. Branch Banking & Trust Co
10. Capital One Financial
11. Citizens Bank
12. Fifth Third Bancorp, OH
13. Huntington Bancshares
14. PNC Financial
15. Regions Bank

A.2. Banks that in Addition to Marketing Clients' Corporate Bonds, Self-Marketed Their Own Bond Issues All the Time

1. Abbey National Treasury Services
2. BNP Paribas SA
3. Bank of America Corp
4. Barclays Bank PLC
5. Bear Stearns Cos Inc.
6. Canadian Imperial Bk Commerce
7. Citigroup Inc.
8. Credit Suisse
9. Goldman Sachs Group Inc.
10. HSBC
11. JP Morgan Chase & Co
12. Jefferies Group Inc.
13. KeyBank NA, Cleveland, Ohio
14. Lehman Brothers Holdings Inc.
15. Merrill Lynch & Co Inc.
16. Morgan Stanley
17. Nomura Holdings Inc.
18. Royal Bank of Canada
19. Royal Bank of Scotland (Bond)

20. Sumitomo Mitsui Banking Corp
21. SunTrust Banks Inc., Atlanta, GA
22. UBS AG Stamford
23. Wachovia Corp, Charlotte, NC

A.3. Banks that Only Market Clients' Corporate Bonds, but Never Self-Marketed Their Own Bonds

1. CIT Group
2. Lloyds TSB Bank PLC
3. Rabobank

Appendix B. Variable Definitions

Dependent Variable

ADJUSTED_DISCOUNT: Calculated by subtracting from the raw discount the same period index return corresponding to the similar rating category, where raw discount is measured as the trade-size weighted average trade price on the second post-offer day of trading minus the offer price expressed as a percentage of the offer price.

Key Explanatory Variable

SELF_MARKETED: Equals 1 if a bank lead–manages its own bond offering, and 0 otherwise.

Control Variables

A: Equals 1 if a bond issue is rated as A, and 0 otherwise. Source: Cai et al. (2007) and Datta et al. (1997).

Baa: Equals 1 if a bond issue is rated as Baa, and 0 otherwise. Source: Cai et al. (2007) and Datta et al. (1997).

5_10_YEARS: Equals 1 if a bond issue's maturity is between 5 and 10 years, and 0 otherwise. Source: Cai et al. (2007).

>10_YEARS: Equals 1 if a bond issue's maturity is above 10 years, and 0 otherwise. Source: Cai et al. (2007).

CALL_OPTION: Equals 1 if a bond issue has a call option built in, and 0 otherwise. Source: Fang (2005).

RATING_DISAGREEMENT: Equals 1 if the specific issue is rated differently by different credit rating agencies.

BOND_PRICE_VOL: The standard deviation of daily bond price changes over the 1-month period after the offer. Source: Yeoman (2001).

DAYS_FROM_PRICING: The number of days between the pricing date and the offer date, where the offer date is identified as the first day that the new bond issue is traded. Source: Corwin (2003).

BID_ASK: The average of the daily effective bid–ask half-spread over the 1-month period after the offer. Source: Ellul and Pagano (2006).

BID_ASK_VOL: The volatility of the daily effective bid–ask half-spread over the 1-month period after the offer. Source: Ellul and Pagano (2006).

ANALYST_COVERAGE: Number of analysts following the issuing firm. Source: Frankel et al. (2006).

OFFER_SIZE: The offer price times the number of bonds issued.

MOVE: Merrill Lynch's measure of implied volatility of U.S. Treasury markets.

VIX: CBOE measure of the implied volatility of S&P500 index options.

YEAR_2009: Equals 1 if the offer date is between Oct. 2008 and Oct. 2009, when a bank debt issue is possibly covered by FDIC's debt guarantee program.

log(NUM_BONDS): The logarithm of the number of outstanding bond issues of the issuer as of the day prior to the offer date.

TOTAL_ASSETS: The total asset of the issuer at the end of fiscal year before the offering.

SHELF_REGISTRATION: Equals 1 if the offering is shelf-registered, and 0 otherwise.

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