Firms' Response to Credit Supply: Evidence from Upsized Corporate Bond Offerings*

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Abstract

Firms often respond to information about investor demand, learned when underwriters build the book to place corporate bonds, by "upsizing" the offering amount. We examine the factors that predict two measures of realized credit supply – oversubscription and yield tightening - and use the unexpected component of credit supply to explain firms' upsizing decision. Firms that appear financially constrained are more likely to upsize in response to unexpected positive credit supply. Even when offerings are upsized, many offerings remain highly oversubscribed, indicating issuers do not increase the issue amount to fully match the credit available. Because firms' fundamentals and financing needs are unchanged in the few hours of bookbuilding, upsizing provides a bond-level measure that can be used to study the impact of credit supply on post-issuance leverage and investment. Firms use the sizeable additional proceeds to reduce bank debt and increase cash holdings; net increases in leverage are temporary. Our evidence does not support concerns of overinvestment in periods of "easy" credit markets.

Keywords: Corporate bonds, primary market, order book size, credit supply, capital raising, upsizing, high yield bonds, credit markets

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1. Introduction

A well-documented finding from macro-finance research is that firms are more likely to issue debt when credit market conditions are strong, and that these times of easy credit are predictive of subsequent downturns and crises (Greenwood et al., 2022). Still, it remains a challenge to understand the extent to which variation in aggregate debt issuance is driven by changes in firms' investment opportunities versus changes in the supply of credit itself; importantly, it is the latter that leads to concerns that firms with weaker prospects become excessively levered and overinvest in less viable projects. Further, a contrasting view is found in the survey evidence of Graham and Harvey (2001) and Graham (2022), revealing that many firms value financial flexibility and do not base their borrowing or investment decisions primarily on interest rates.[1] Thus, it remains unclear whether and how a more elastic supply of credit – often assumed in "overheated" markets (Stein, 2014) – induces a given firm to change its financing and investment policies.[2]

In this paper, we employ a unique setting that allows us to observe firms' response to credit supply as they set the price (yield spread) and quantity for their bond offerings. Specifically, we study firms' response to the supply of credit observed in the few hours when investors' primary market orders are taken to build the "book", but during which firms' fundamentals and demand for capital remain unchanged. We use this setting to show a direct link between credit market conditions, security-level credit supply, and firms' response to the unexpected component of credit

[1] Literature on the value of financial flexibility and its impact on corporate decisions includes: DeAngelo and DeAngelo, 2007; Denis, 2011; Denis and McKeon, 2012; DeAngelo, Goncalves, and Stulz, 2018; and Fahlenbrach, Rageth, and Stulz, 2021.

[2] At the extreme, Axelson, Jenkinson, Strömberg, and Weisbach (2013) show that the level of debt used to finance leveraged buyouts is primarily determined by financing costs rather than firm fundamentals. Additional studies providing evidence that firms respond to market conditions by issuing equity or bonds are discussed below.

supply by increasing the offering quantity, a practice known as "upsizing". We are then able to investigate whether the sizeable proceeds from upsizing lead to permanent changes in firms' leverage or investment, holding constant firms' initial demand for capital and perceived investment opportunities.[3] This setting helps us to overcome a long-standing empirical challenge when trying to isolate and quantify the impact of capital supply on firms' real policies.

For a comprehensive sample of 8,676 U.S. corporate bond offerings issued between 1995 and 2018, we identify whether the offering amount is changed after bookbuilding using information extracted from issuers' SEC filings and news from Bloomberg. We find that 11.7% of investment-grade (IG) bonds and 34.3% of high-yield (HY) bonds are upsized, on average increasing the issue size by 33.1% and 29.9% from the initially proposed offering amount.[4] Few bonds are downsized, mostly at the start of recession periods. For simplicity, throughout this paper we use "upsizing" to refer to offering quantity adjustment. The additional proceeds to issuing firms can have economically large effects on subsequent financing and investment policies: in our sample, the increase in proceeds averages $147.0 ($112.7) million for upsized IG (HY) offerings, representing 82.1% of IG (129% of HY) issuers' annual capital expenditures.

We first provide new stylized facts on the outcomes of bookbuilding, which we use to indicate security-level realized credit supply. Using novel data for the primary market order book size for 2,491 IG bonds issued after September 2010, we show that IG offerings have an average oversubscription ratio - the order book size scaled by the initially proposed amount - of 4.13. The surprisingly high book size indicates unfilled investor demand at the offering price, suggesting that

[3] A similar argument is used by Becker and Ivashina (2014), who use the substitution between bank loans and corporate bonds to control for firms' demand for debt capital when studying the credit supply effects of bank loans. In this paper, we use the terms investor demand and credit supply interchangeably.

[4] This pattern may suggest that the greater incidence of upsizing among HY offerings is due to underwriters setting the initially proposed offering amount more conservatively (lower) for riskier offerings. We discuss the validity and implication of possible conservatism for our results in Section 6.3.

issuers do not nearly borrow the maximum amount available based on investors' orders. High investor demand is also evidenced by the incidence of yield tightening, measured as the difference between the final offering yield spread over the Treasury benchmark rate and the yield spread disclosed to investors prior to bookbuilding (hereafter "spread compression"). Consistent with Wang (2021), nearly all IG issuers tighten the yield following bookbuilding. For IG offerings, where we can observe both oversubscription and spread compression, the correlation of these two measures of credit supply is -0.52. For HY issuers, where order book data is not public, but concerns of excessive leverage and overinvestment as a result of strong credit conditions are most acute, we use spread compression to measure realized credit supply.

Using several measures established in prior literature, we show that the oversubscription ratio and spread compression capture variation in credit market conditions. Both of these issue-level indicators of credit supply closely track the time series of aggregate capital available to bond issuers from bond mutual funds (Ben-Rephael, Choi, and Goldstein, 2021), which is measured by shifts in investors' portfolios towards the IG or HY sector. In addition to their measure, multivariate regressions, which include both industry and rating fixed effects, show that both IG and HY offerings receive stronger credit supply when the yield difference between long- and short-term Treasuries is smaller; IG offerings receive stronger credit supply when the "excess bond premium" (Gilchrist and Zakrajšek, 2012) is greater. The average oversubscription or spread compression from the prior month's offerings is also strongly predictive of credit supply realized for a subsequent offering. We further show that stronger credit supply for a given offering is related to reaching-for-yield behavior, though only for IG offerings (consistent with Becker and Ivashina, 2015, and Choi and Kronlund, 2018); oversubscription and spread compression are greater for IG

offerings whose the credit rating carries a "-" notch, which provide higher yields than other offerings of the same letter rating category.

When realized investor demand is high, issuers appear to exercise wide discretion in their decision to upsize. For example, when the oversubscription ratio is greater than 4.5, a level indicating exceptionally strong credit supply, only 16% of these issuers upsize the offering. Understanding firms' choices of upsizing can shed light on how easy credit supply affect capital raising behavior. While our first set of regressions explaining oversubscription and spread compression show the factors driving realized credit supply for a given offering, it is the unexpected component of credit supply that is important to understanding upsizing behavior, i.e., how firms adjust the offering amount based on the difference between the expected credit supply and that learned from bookbuilding. We therefore use these to estimate residual demand, calculated as the difference between the realized and predicted credit supply variable. We then use the estimate of unexpected credit supply as explanatory variables in a second-stage regression to examine the determinants of firms' upsizing decision. The results strongly support the interpretation that upsizing reflects firms' response to unexpected positive credit supply.

Focusing on firms' decision to upsize, we further study how the sensitivity of upsizing to realized credit supply varies with issuer characteristics. Financing constraints are often viewed as limiting firms' access to capital, such that a strong realization of credit supply should lead constrained firms to borrow more (see Farre-Mensa, Ljungvist, and Schroth, 2022, among others). On the other hand, firms may choose not to upsize if they lack additional debt capacity, would suffer from debt overhang, or seek to maintain financial flexibility (Graham, 2022 and others). Further, firms that lack positive NPV investment opportunities for the additional proceeds may choose not to upsize, even when credit supply would accommodate a larger offering.

We find that firms which are likely to be financially constrained are more likely to respond to realized credit supply by upsizing, consistent with the importance of financial constraints to firms' capital-raising decisions. Lower-rated issuers, rated either BBB, or rated BB or below, are more sensitive to the unexpected component than the highest-rated issuers (rated A or above), as are firms with higher leverage pre-offering and those with higher HP index (Hadlock and Pierce, 2010). We also find that firms with higher Tobin's Q are less likely to respond to realized credit supply by upsizing, likely because they are less financially constrained than firms with lower Tobin's Q.

In the final step of our analysis, we examine firms' financing and investment decisions when they take advantage of available credit supply by upsizing. Strong credit supply may lead to higher leverage, especially if firms use proceeds to pay out to equity holders or repurchase shares. Alternatively, firms may use the additional funds to preserve financial flexibility by increasing cash balances or by refinancing more expensive or restrictive debt. Additional proceeds also enable firms to invest more, which is helpful for financially constrained firms that have good investment opportunities, but may cause overinvestment for firms lacking positive NPV projects.

We compare changes in firm policies for upsizing issuers with non-upsizing issuers (those who do not experience a positive realization of investor demand or who do experience strong demand but choose not to upsize) using a difference-in-differences (DID) framework in the nine-quarters around the quarter of an offering. Because our evidence shows important differences across firms in their reaction to strong credit supply, a potential concern is that firm characteristics that determine the upsizing decision also affect the use of proceeds after raising debt. To address this concern, we employ the "overlap weighting" method (Li, Morgan, and Zaslavsky, 2018;

Bartram, Conrad, Lee, and Subrahmanyam, 2021) to generate similar distributions of all firm characteristics and market condition covariates across upsizing and non-upsizing issuers.

We use this approach to first compare changes in the capital structure and equity payouts of upsizing versus non-upsizing issuers, relative to quarter -4. For each $1 of upsized capital raised by IG issuers, bank debt falls by $0.552, cash holdings increase by $0.482, and leverage (total debt) increases by $0.732 relative to non-upsizing issuers in the offering quarter. The substitution of bonds for bank debt remains over the following four quarters, while the increases in cash holdings and leverage are statistically significant but decline with time. Similarly, HY issuers that upsize their bond offerings decrease their bank debt, and increase cash holdings and leverage; the changes for cash holdings and leverage become statistically insignificant by quarter 4. These results are robust using the subsample of issuers that all experience positive investor demand (i.e., those that either compress the offering yield or upsize). Further, we find little evidence that either IG or HY issuers use additional funds to substitute for equity financing or increase payouts.

We further study whether issuers use additional capital from upsizing to increase investment relative to the four quarters ending prior to the offering date. For IG firms, we find that post-issuance capital expenditures are greater for firms with higher investment opportunities (Tobin's Q), but do not respond to upsizing events. For HY issuers, we find weak evidence of an increase in post-issuance capital expenditures for upsizing firms, but only for firms with *higher* Tobin's Q. Overall, we find little evidence consistent with overinvestment, despite the fact that the additional proceeds from upsizing are large relative to firms' annual capital expenditures.

Our work advances recent literature that examines the role of uncertainty and information asymmetry associated with corporate bond offerings. This work links behavior in the primary and secondary markets to corporate bond allocations (Nikolova, Wang, and Wu, 2020), IPOs

(Bodnaruk and Rossi, 2021), offering yields (Wang, 2021), and trading by underwriters (Goldstein, Hotchkiss, and Nikolova, 2021; Bessembinder et al., 2022). Siani (2022) uses primary market information to model the endogenous response of bond investors to underpricing, which impacts the cost of borrowing over the credit cycle. We add a new dimension to this literature by showing that the realization of investor demand during bookbuilding substantially impacts the amount of capital raised and its subsequent effects on firm policies.

We further contribute to the large literature showing that "easy" credit markets predict economic downturns, with the key assumption that firms on average respond to overheated credit markets aggressively.[5] Prior studies have focused on the importance of macroeconomic conditions for explaining aggregate credit supply, based on time-varying financial market frictions (Holmstrom and Tirole, 1997; Kiyotaki and Moore, 1997). A large related literature shows that firms' gross issuance of debt is procyclical (Altman et al., 2019). Our micro-level evidence based on firms' upsizing response to information learned from bookbuilding enables us to observe a component of firms' response to credit supply that is not confounded by the correlation between credit market conditions and investment opportunities. We find that firms on the margin rarely raise as much debt as possible in response to time-varying credit supply, and that the decision to raise additional debt varies significantly with firm characteristics. Our findings imply that changes in firms' investment opportunities drive a significant portion of the decision to issue debt found by prior literature.

The aforementioned macroeconomic studies also suggest that the gross debt issuance of riskier firms is more sensitive to accommodative credit market conditions. In contrast, Ma (2019) shows that larger firms are better able to substitute debt for equity when debt is cheap, while

[5] See, for example, Gertler and Lown (1999), Greenwood and Hanson (2013), López-Salido, Stein, and Zakrajšek, (2017), and Ben-Rephael, Choi, and Goldstein (2021).

Crouzet and Mehrotra (2020) show that smaller, riskier firms do not respond differently to financial shocks than larger firms. Because firms' investment opportunities are held constant in the short window of bookbuilding, we are able to show that easy credit supply does not necessarily result in permanent increases in leverage for riskier firms. Instead, firms use large amounts of the proceeds raised to improve their financial flexibility by changing the composition of their debt, often refinancing more expensive debt. Thus, the impact of credit market conditions on capital structure likely differs from that of equity market valuations, which have long-lasting effects on capital structure (Baker and Wurgler, 2002).

Finally, our study speaks to concerns that firms overinvest as a result of strong credit supply. While papers such as Lemmon and Roberts (2010) find that a severe negative shock to credit availability (disruption of the high yield market with the collapse of Drexel Burnham) leads to a contraction in investment, we do not find that the opposite effect (overinvestment) is of concern at more benign points in the credit cycle.[6] Instead, our findings echo the most recent survey evidence of Graham (2022), showing that corporate CFOs view preserving financial flexibility and maintaining credit ratings as more important than factors such as interest rate costs. This aspect of our findings is also consistent with Zhu (2021), who shows that the relation between the component of firms' debt issuance driven by fund flows of their mutual fund bondholders and the firm's concurrent level of investment is insignificant. Different from these studies, our novel measure based on upsizing enables us to unambiguously identify a large amount of additional debt proceeds raised due to unexpectedly positive credit supply, often exceeding firms' annual capital expenditures, and link the increase in capital to subsequent leverage and investment decisions.

[6] See, for example, Chernenko and Sunderam (2012) and Becker and Ivashina (2014) for discussions of papers that find a negative effect of adverse credit supply shocks for constrained firms.

2. Institutional Background

Most corporate bonds are announced and priced on the same day (Grennan and Musto, 2018).[7] Typically, within only a few hours, underwriters obtain orders from investors to determine the book, and based on observed demand decide whether or not to change the offering amount and/or yield. To illustrate this timeline, we use the offering of Marriott's 4.5% coupon 8-year senior note maturing 06/15/2029. All events in the following table occur on 06/07/2021.

Time	Event
7:07 am	The offering is announced, with a proposed offering amount of $450 million and initial pricing of "high 4s"
10:00 am	Price talk is announced, with an offering amount of $450 million and pricing range of 4.5%-4.75%
11:00 am	Investor call
12:42 pm	The offering is launched, with the offering amount *upsized* to $500 million and yield tightened to 4.5%
13:30 pm	Book closes
14:00 pm	The offering is priced, with a final offering amount of $500 million and 4.5% yield

In this example, bookbuilding begins in the early morning and ends in the early afternoon. The final price and quantity are determined after underwriters collect investors' orders, when uncertainty regarding investor demand has been resolved. Given the tight timeline within the day, firms' response to information learned from the book reflects their realization of credit supply, rather than changes in firms' fundamentals or financing needs.

In Appendix A, we provide a firm-demand and investor-credit-supply framework to illustrate firms' possible responses to credit supply information learned from bookbuilding --

[7] Given the short time window when bonds are priced, issuing firms typically instruct underwriters beforehand whether and by how much to increase the offering size as orders are taken for the book. Unlike equities, greenshoe options are rarely used for corporate bond issues.

adjusting the offering yield, quantity, or both. The simultaneous tightening of yield and issue upsizing indicates a stronger than expected realization of credit supply rather than a tradeoff between price and quantity along the issuer/underwriter's anticipated credit supply curve.

3. Data

3.1 Sample Construction

Our sample period is from 1/1/1995 (the start of SEC Edgar electronic filings) to 5/31/2018. From FISD, we obtain characteristics of all fixed-rate corporate debentures issued by US non-financial non-utility firms, excluding perpetual, Yankee, asset-backed, and mortgage bonds, bonds issued as part of an exchange offer, and bonds with a missing offering date, offering price, or maturity. We also exclude convertibles and medium-term notes, which utilize a different offering process. We obtain credit ratings from FISD and S&P Capital IQ (CIQ), and exclude bonds that are unrated or rated below CCC. These criteria yield 12,931 bond offerings.

We search SEC filings to identify upsized bond offerings and retain 8,864 offerings for which we find at least one relevant filing.[8] Public bond issuers file a prospectus, whereas both public and Rule 144A bond issuers use Form 8-K to disclose the offering if it is deemed material (Securities Exchange Act of 1934). For each bond offering, we extract the *initial offering amount* from pre- or post-offering filings. If a bond's initial offering amount is different from the offering amount recorded in FISD or in post-issuance filings, we manually read all filings as well as Bloomberg news to verify whether the offering is upsized and the upsizing amount.

We obtain the order book size and initially proposed offering yield (the yield disclosed to investors prior to bookbuilding) from Bloomberg and Refinitiv. Refinitiv provides primary market

[8] Of the 12,931 FISD bonds, we exclude 2,357 bonds with no CIK matched, 1,679 bonds with no relevant SEC filings, and 31 bonds whose registration type is "F-3" or "F-4".

information collected from underwriters for bonds offered after September 2010. While the initial offering yield is available for both IG and HY offerings, the order book size is only available for IG offerings. We match issuers to Compustat and CIQ to obtain accounting and debt structure variables, excluding an additional 188 bonds from the sample. For private firms, due to the lack of stock price information, we use the firm's Fama-French 12 industry average Tobin's Q to measure growth opportunities. Finally, we obtain ICE BofA bond index yields by rating and maturity from Thomson Reuters Datastream.

3.2 Summary Statistics

Table 1 presents summary statistics for our 8,676 sample bond offerings, of which 5,388 are IG and 3,288 are HY. All variables are winsorized at 1% and 99%, and Appendix B contains variable definitions. We find that upsizing is common: 1,757 of our 8,676 sample bond offerings are upsized; IG bond offerings are less likely to be upsized (11.7%) than HY bonds (34.3%). When a bond offering is upsized, the magnitude is substantial, averaging 33.1% of the initial offering amount for IG bonds and 29.9% for HY bonds.

We define the *Oversubscription Ratio* as the order book size scaled by the initial offering amount. For IG offerings, the average oversubscription ratio is 4.13, meaning the average order book is more than four times the offering amount. To measure yield adjustment, we calculate *spread compression* as the difference between the offering spread and the initially proposed spread. The average spread compression for IG (HY) offerings is -15.27 (-5.50) bps with a standard deviation of 11.47 (22.99) bps, consistent with Wang (2021) that spread compression is extremely frequent and is larger for IG offerings but more variable for HY offerings. For IG (HY) offerings, 91.41%, 4.01%, and 4.58% (58.62%, 20.53%, and 20.86%) of offerings exhibit negative, zero, or positive spread compression, respectively.

While both upsizing and spread compression increase the cash flow available for future investment, the immediate dollar proceeds from upsizing are large and can have a significant impact on both leverage and near-term investment decisions. For the median bond in our sample, upsizing of 33% of an initial offering amount of $400 million yields an additional $132 million in proceeds to the issuing company. The impact of yield tightening on available cash is much smaller; reducing the yield by 15 bps reduces coupon payments by $0.60 million per year.

3.3. Stylized Facts

Because we are the first to study how bond-level credit supply affects firms' decision to raise additional debt, we present some stylized facts regarding oversubscription ratio, spread compression, and upsizing using the subsample of IG offerings for which all three variables are available. Univariate statistics in Table 2 first show that both the incidence and magnitude of spread compression monotonically increase with oversubscription. The percentage of offerings that exhibit spread compression increases from 66.7% when the oversubscription ratio is smaller than 1.5, to 98.2% when oversubscription is greater than 4.5. The average spread compression increases from -3.34 bps to -22.38 bps as the oversubscription ratio increases. Spread widening occurs only within the 30 observations of BBB bonds with oversubscription ratios less than 1.5. This description indicates a strong positive relationship between investor demand and the offering price.

Table 2 further shows that the incidence of upsizing increases monotonically with oversubscription. In our sample, issuers never upsize offerings with an *Oversubscription Ratio* of less than 1.5, consistent with underwriters' view that the book size should be at least 1.5 to 2 times the offering amount to ensure a successful offering (Feldstein and Fabozzi, 2008). The percentage of offerings upsized when the oversubscription ratio is 4.5 or greater is nearly four times that observed when the oversubscription ratio falls between 1.5 and 3. However, even for offerings

with an oversubscription ratio greater than 4.5, the percentage of upsizing offerings is only 15.8%, showing that firms do not always raise the maximum amount of capital available from investors. This pattern is consistent with firms' tendency to maintain financial flexibility by not exhausting their debt capacity (Graham, 2022).

Although we cannot observe book size for HY offerings, the lowest credit quality IG offerings (BBB) have a substantially greater proportion of upsizing than higher-rated offerings. To the extent they are more financially constrained, this finding suggests lower credit quality issuers are more likely to take advantage of strong investor demand by increasing the size of their offering.

4. Drivers of Credit Supply

In this section, we show that bond-level investor demand reflects market-wide credit supply conditions for fixed-income securities. We focus on macroeconomic indicators and reaching-for-yield behavior expected to drive overall credit supply.

Our direct measure of bond-level investor demand, the oversubscription ratio, is only publicly observable for IG bond offerings, but concerns of excessive leverage and overinvestment are most acute for lower credit quality companies. To overcome this issue, we use the degree of spread compression, which is available for both IG and HY offerings in 2010 and later, as an alternative indicator of bond-level investor demand. Classic bookbuilding theories suggest that a more positive price update reflects greater investor demand (e.g., Benveniste and Spindt, 1989), consistent with the close relation we find in Section 3.3 between the oversubscription ratio and spread compression (i.e., price update).[9] Furthermore, the multinomial results in Table C1 of Appendix C suggest that spread compression and upsizing are more likely to be complements

[9] In the equity IPO literature, a positive (negative) offer price adjustment is used to proxy for hot (cold) IPOs. Zhang, Zhang, and Zhao (2022) use negative yield spread adjustment in the primary market for leveraged loans to indicate greater investor demand.

rather than substitutes when realized investor demand is high. Therefore, we use spread compression as an alternative measure of bond-level credit supply.

4.1 Univariate results

To understand how the oversubscription ratio and spread compression vary with macro conditions, we first examine the investor-demand-based measure of *aggregate* credit supply developed by Ben-Rephael, Choi, and Goldstein (2021) - the monthly intra-family investor net exchanges for IG (HY) corporate bond mutual funds (*IG-NEIO* and *HY-NEIO*). We use NEIO to measure credit market conditions for two primary reasons. First and foremost, it directly measures changes in credit supply from a large subset of corporate bond investors. Second, Erel et al. (2012) show that debt issuance is counter-cyclical for IG firms but pro-cyclical for non-IG firms. By separating *IG-* and *HY-NEIO*, we can account for differential credit supply to the IG and HY sectors across credit cycles. To indicate credit supply conditions when the bond is offered, we measure NEIO at the month of the bond offering.

Panel A of Figure 1 shows that the oversubscription ratio for IG bond offerings closely comoves *IG-NEIO*. Panel B (Panel C) shows higher *IG-* (*HY-*) *NEIO* is associated with greater (i.e., more negative) spread compression for IG (HY) offerings. These plots suggest that the oversubscription ratio and spread compression reflects changes in aggregate credit supply.

Based on prior empirical findings, we expect greater investor demand for higher-yielding IG offerings. Data are available for the oversubscription ratio and spread compression for bonds offered in the period between September 2010 and May 2018, during which the risk-free rate is generally low and institutional investors have been shown to reach for yield in the IG sector (Becker and Ivashina, 2015; Choi and Kronlund, 2018).

We measure bond's attractiveness to investors reaching-for-yield investors, based on whether its credit rating carries a "+" sign or "-" sign.[10] Specifically, *Plus Notch* includes bond offerings whose credit rating carries a "+" sign, *No Notch* includes offerings with no sign in their credit rating, and *Minus Notch* includes offerings whose credit rating carries a "-" sign. Panel A of Figure 2 shows the average oversubscription ratio of *Plus, No,* and *Minus Notch* offerings within each letter rating category. On average, bonds with a *Minus Notch* within A and BBB rating categories (which together account for 91% of sample IG bonds) have a greater oversubscription ratio than other bonds, consistent with stronger credit supply when IG investors reach for yield.

Panel B of Figure 2 shows the average spread compression of *Plus, No,* and *Minus Notch* offerings within each letter rating category. Although prior literature does not suggest reaching-for-yield in the HY sector, we include HY offerings for completeness. Again, bonds with a *Minus Notch* within A and BBB rating categories experience a larger spread compression, consistent with the pattern shown in Panel A. For the HY sector, we observe no clear evidence of reaching-for-yield.

4.2 Multivariate results

In this section, we use multivariate regressions to examine the relationship between credit market conditions and our indicators of investor demand, which allows us to consider further measures of market conditions and to control for bond and firm characteristics. In addition, investor demand for other recent offerings may be predictive of investor demand for new offerings at times when market conditions are stable; we therefore also include as explanatory variables the

[10] Prior literature uses the Treasury spread (Becker and Ivashina, 2015) or yield relative to the yield of the rating- and maturity-matched bond index (Choi and Kronlund, 2018) to indicate higher yielding securities. We do not employ these measures which are calculated using the offering yield because our indicator of investor demand (i.e. *spread compression*) is based on the change in the offering yield: based on reaching-for-yield, a higher initial offering yield attracts more investor demand, but also enables underwriters to decrease the offering yield. In contrast, whether a bond's credit rating carries a "+" or "-" sign is not affected by the realized investor demand.

oversubscription ratio or spread compression of bonds offered in the prior month. Specifically, we estimate the following model:

$$Investor\ Demand_i = \alpha + \beta_1 Market\ Condition_i + \beta_2 Minus\ Notch_i + \pi Prior\ Demand_i + \theta_1 Bond\ Char_i + \theta_2 Issuer\ Char_i + FE + u_i, \quad (1)$$

where the dependent variable *Investor Demand* is either the *oversubscription ratio* or *spread compression* for IG offerings, and is *spread compression* for HY offerings. *Market Condition* includes monthly *NEIO* (*IG*- or *HY*-), *High Yield Share* (*HYS*, Greenwood and Hansen, 2013), *Excess Bond Premium* (Gilchrist and Zakrajšek, 2012), the 1-year Treasury rate, Treasury slope, and T-Bill rate forecast dispersion. *Prior Demand*, the average oversubscription ratio or spread compression of all offerings in the month prior to the new offering date, is calculated for IG and HY offerings separately. *Bond Char* includes the initial offering amount, maturity, Rule 144A indicator, and an indicator of whether the offering is the issuer's first bond offering. *Issuer Char* includes Tobin's Q, return on assets, book leverage ratio, sales, and an indicator of whether the issuer has outstanding syndicated loan contracts. We include letter credit rating and Fama-French 12-industry fixed effects. We estimate this equation separately for IG and HY issuers using ordinary least squares (OLS) regressions, with robust standard errors clustered by issuer.

Table 3 presents regression results, which confirm our observations from Figures 1 and 2. Even-numbered columns control for *Prior Demand*, which slightly reduces our sample size, whereas odd-numbered columns do not. In particular, IG (HY) bonds experience greater oversubscription and larger spread compression when *IG-NEIO (HY-NEIO)* is higher. Results in columns (3) and (5) suggest that a one standard deviation increase in *IG-NEIO* (0.04 bps) and HY-NEIO (0.17 bps) are associated with a 0.79 and 2.03 increase in the spread compression, respectively, accounting for 6.89% and 8.83% of its standard deviation in the regression sample

(11.47 and 22.99). Also, IG bonds with a *Minus Notch* receive a greater oversubscription ratio and experience larger spread compression, but this pattern does not exist for HY offerings. These findings are consistent with reaching-for-yield in the IG but not HY sector. For other market condition indicators, we find evidence that bond offerings receive greater investor demand when the Treasury Slope is flatter, likely because investors turn to the corporate bond market to earn higher yields when even long-term Treasury yields are low. As an indicator of the price of credit risk and investor sentiment, HYS is mostly insignificant, likely because of our controls for other macro conditions. Interestingly, IG bond offerings receive greater investor demand when EBP is higher, but not HY offerings. This could be due to a flight to quality (i.e., IG bond offerings) when market conditions worsen.

We further find that the *Prior Demand* strongly predicts investor demand for new IG offerings but not for HY offerings. Columns (2) and (4) suggest that for IG offerings, a 1% increase in the past average oversubscription ratio increases the oversubscription ratio of a new offering by 0.2%, and a 1 bps increase in the prior spread compression increases the spread compression of a new offering by 0.4 bps. From column (6) for HY offerings, the impact of past spread compression appears both statistically and economically small. This result is likely due to the greater heterogeneity and uncertainty associated with HY offerings. In unreported analysis, we find similar results when we replace the average oversubscription in the prior month with that calculated in the previous week, though this replacement more significantly reduces our sample size and eliminates periods of relatively weaker macro conditions when few issuers tap the market.

For bond characteristics, we find that for IG offerings, a smaller offering amount, longer maturity, and issuers' first bond offering receive larger book size, but these characteristics mostly do not affect the magnitude of spread compression. For HY offerings, issuers' first bond offerings

have a smaller magnitude of spread compression, indicating that they are less welcomed. Results on issuer characteristics suggest that for IG offerings, riskier issuers with a greater leverage ratio receive less favorable investor demand; firms with a larger amount of sales, likely larger issuers, also receive worse investor demand, which could be due to their larger total amount of debt issuance. For HY offerings, firms with better investment opportunities, as evidenced by Tobin's Q, receive more favorable investor demand.

5. Upsizing and Credit Supply

Using oversubscription ratio and spread compression as our indicators of credit supply conditions, we examine whether firms respond to strong realizations of investor demand by upsizing. It is important to note that it is the unexpected component of realized credit supply which is relevant to underwriters' and issuers' decision to significantly increase the size of an offering.

5.1 Upsizing and NEIO

Because the oversubscription ratio and spread compression are only available for the later half of the sample period that we can observe upsizing, and both measures closely follow NEIO (Figure 1), we first plot average upsizing against NEIO as an illustration of the relationship between upsizing and credit supply conditions. Figure 3 plots the annual percentage of upsized IG (HY) bond offerings and *IG- (HY-)NEIO*. Panels A and B show that upsizing closely tracks *IG-NEIO* and *HY-NEIO*, respectively. These patterns strongly suggest that conditional on firms' demand, easier credit supply is associated with firms' ability to upsize. It may at first appear counter-intuitive that upsizing increases late in the financial crisis (2008-09), raising the question of whether underwriters' conservativeness drives the time series of upsizing. However, upsizing closely tracks *IG-NEIO* and *HY-NEIO*, both of which indicate upward shifts in credit supply at this time.

Figure 3 also shows that few bond offerings are downsized, even during economic downturns. Over the entire sample period, only 0.5% of sample IG bonds and 3.6% of HY bonds are downsized (on average, 14.1% and 12.6% reduction of the offering amount for downsized IG and HY bonds, respectively), largely just prior to the start of recession periods. Downsizing appears to increase somewhat at times when NEIO declines. Together with our finding that most offerings update the offering yield after bookbuilding, the lack of downsizing likely reflects that firms adjust prices rather than quantities to ensure they successfully raise their needed capital.

5.2 How Does Credit Supply Affect Firms' Decision to Upsize?

We proceed to examine how firms respond to realized demand by upsizing in a multivariate setting, controlling for bond and firm characteristics. Because bond underwriting is a repeated game for underwriters, it is reasonable to consider that some components of the observed oversubscription ratio and spread compression are expected. To capture the impact of *unexpected* credit supply on upsizing, we use a two-stage regression approach. Specifically, in the first stage we re-estimate equation (1), but not controlling for NEIO because the aggregate NEIO for the offering month is not known to anyone until at least the month after the offering.[11] In other words, we assume that innovations in NEIO are a source of unexpected credit supply. We obtain the residual term and label it as *Resi Demand*, which we use to estimate the second-stage regression. For ease of interpretation, when *Resi Demand* is estimated using *Spread Compression* as the measure of investor demand, we take the negative value of the residual term, such that higher *Resi Demand* indicates greater unexpected investor demand. Then, we estimate the second-stage regression as follows:

[11] We do not include NEIO to avoid using looking-ahead information. However, in unreported results, we find that our second-stage regression results are robust to the inclusion of NEIO in the first-stage regression.

$$Upsize\ Dummy_i = \alpha + \beta Resi\ Demand_i + \theta_1 Bond\ Char_i + \theta_2 Issuer\ Char_i + FE + u_i\ , \quad (2)$$

where i indexes a bond offering. *Resi Demand* is discussed above and is winsorized at 1st and 99th percentile to avoid extreme values. *Bond Char*, *Issuer Char*, and fixed effects are the same as in equation (1), except that we also control for year-fixed effects in lieu of macro condition indicators. We estimate an OLS regression for equation (2). Because we use a predicted value as an independent variable, we obtain robust standard errors by bootstrapping the two-stage regressions 1,000 times.

Since the first-stage results are very similar to those reported in Table 3, except for excluding NEIO as an independent variable, we report these results in Appendix C, Table C2. Table 4 reports the second-stage regression results. For even-numbered columns, the first-stage regressions include the *Prior Demand*, whereas for odd-numbered columns, *Prior Demand* is not included in the first stage. Columns (1) and (2) (columns (3) - (6)) show the second-stage results where *Resi Demand* is predicted using the oversubscription ratio (spread compression) as the investor demand indicator.

Columns (1)-(4) shows that using either the oversubscription ratio or spread compression to indicate investor demand for IG offering, the likelihood of upsizing strongly increases with *Resi Demand*. For example, results in column (1) suggest that a one standard deviation increase in the *Resi Demand–oversubscription ratio* (1.85) increases the likelihood of upsizing by 2.04%, which is 22.79% of its mean value (8.95%). Columns (5)-(6) suggests that using spread compression to indicate investor demand for HY offering, the likelihood of upsizing strongly increases with *Resi Demand*. Results in column (5) suggest that a one standard deviation increase in the *Resi Demand—spread compression* (21.43) increases the likelihood of upsizing by 4.29%, which is 10.68% of its mean value (40.15%).

These results are robust to including rating by offering date fixed effects in the second stage (unreported). We reach similar conclusions when we analyze the relation between the magnitude of upsizing – *Upsize Magnitude* – and *Resi Demand* (Table C3 of Appendix C). Notably, the predicted investor demand from the first stage regression, rather than the residual term, is not a significant determinant of upsizing (Table C4 of Appendix C), further supporting our argument that upsizing reflects firms' response to unexpected credit supply.

For other explanatory variables, columns (1)-(4) suggest that larger offerings are less likely to be upsized, and none of the other *Bond Char* or *Issuer Char* are significant determinants of upsizing for IG offerings. For HY offerings, columns (5) and (6) show that firms with higher Tobin's Q and higher sales and, thus, in more need of capital are more likely to upsize, all else equal. Overall, our findings in this section indicate that some firms respond to unexpected positive credit supply by increasing their offering amount.

5.3 Does Upsizing Depend on Firm-Level Characteristics?

Section 3.3 shows that firms almost always tighten the offering yield whenever credit supply permits. Upsizing is less frequent, even when the oversubscription ratio is large, but delivers substantial additional dollars to issuers and could lead to large increases in leverage or investment. Understanding firms' decision to upsize upon accommodative credit supply is of key importance in understanding the consequences of strong credit markets.

We expect the decision to upsize when issuers receive strong investor demand to reflect the degree of their financial constraints. On the one hand, firms with greater financial constraints may take advantage of positive credit supply and raise more debt. On the other hand, they may lack the debt capacity to further increase their leverage. Furthermore, firms with greater growth

opportunities may be more likely to upsize when investor demand is strong to meet their capital needs, especially if these firms are financially constrained.

To understand how financial constraints affect the decision to upsize, we modify equation (2) to allow firms with different degrees of financial constraints to respond differently to realizations of investor demand. Because the degree of financial constraints varies more dramatically across the IG-HY boundary than within IG or HY sectors, we conduct this analysis using a sample of both IG and HY offerings. Specifically, we estimate the following model:

$$\begin{aligned} Upsize\ Dummy_i = \alpha + \beta_1 Resi\ Demand_i \times High\ FC_i + \beta_2 Resi\ Demand_i \times Mid\ FC_i + \varphi_1\ High\ FC_i + \\ \varphi_2\ Mid\ FC_i + \pi Resi\ Demand_i + \theta_1 Bond\ Char_i + \theta_2 Issuer\ Char_i + FE + u_i, \end{aligned} \quad (3)$$

where i indexes a bond offering. Using *Spread Compression* to measure investor demand, which is available for both IG and HY offerings, we obtain *Resi Demand* as in equation (2); because our regressions include industry and year fixed effects, and because credit rating is a common measure of firm-level constraints, we compute deciles of residual demand by rating and year. Financial constraint (FC) is proxied by rating, leverage ratio, WW index (Whited and Wu, 2006), or HP index (Hadlock and Pierce, 2010).[12] When using rating as a measure of financial constraint, *High FC*, *Mid FC*, and *Low FC* (the omitted group) equals one for observations with rating of AAA/AA/A, BBB, and BB and below, and zero otherwise. When using leverage ratio, WW index, or HP index as a measure of financial constraint, *High FC*, *Mid FC*, and *Low FC* equals one for observations that rank at the top, medium, and bottom tercile in the yearly distribution of the measure, and zero otherwise. Bond and issuer characteristics are as in equation (2), except that we

[12] We calculate WW index and HP index following Farre-Mensa and Ljungqvist (2016). Specifically, WW index is calculated as –0.091 [(*ib* +*dp*)/*at*] – 0.062[indicator set to one if *dvc* + *dvp* is positive, and zero otherwise] + 0.021[*dltt/at*] – 0.044[log(*at*)] +0.102[average industry sales growth] – 0.035[sales growth]. HP index is –0.737Size + 0.043Size^2 – 0.040Age, where Size equals the log of inflation-adjusted Compustat item *at* (in 2004 dollars). We calculate Age as the number of years the firm is in Compustat. Furthermore, Size is capped at (the log of) $4.5 billion and Age at 37 years following Hadlock and Pierce (2010).

exclude the leverage ratio when using it to proxy for the degree of financial constraint. We also include year and industry fixed effects. Robust standard errors are obtained from bootstrapping the two-stage regressions 1,000 times.

Results in Table 5 suggest that the upsizing decision of more financially constrained firms is more sensitive to the realization of investor demand. Because we estimate previous equations separately for the IG and HY sectors, in column (1) we first show whether HY firms as a group respond to investor demand differently than IG firms. The coefficient for the interaction term between *HY* and *Resi Demand* is positive, albeit not significant (t=1.55), consistent with our conjecture that HY firms respond more aggressively to investor demand by upsizing. Results in column (2) show that compared to the highest-rated AAA/AA/A offerings, lower-rated BBB as well as BB and below offerings each respond to positive realizations of investor demand significantly more aggressively. A t-test of the coefficients of the interaction terms shows no statistical significance (p value=0.60). Column (3) shows that firms whose leverage ratio ranks in the top tercile respond more aggressively to positive realizations of investor demand. Using WW index as a measure of financial constraints does not yield a significant difference in the upsize-to-demand sensitivity (column (4)), possibly because bond issuers are in general larger firms that are less likely to fall into the constrained category defined by WW measure for a wide sample that includes small firms (Farre-Mensa and Ljungqvist, 2016). Column (5) shows that issuers with Mid and High HP index respond more aggressively to positive realizations of investor demand than issuers with Low HP index. Although the coefficient of *High FC*Residual Demand* appears smaller than that of *Mid FC*Residual Demand*, they are not statistically different from each other (p value=0.31).

To understand the impact of growth opportunities on upsizing-to-demand sensitivity, we modify equation (3) and estimate the following model:

$$Upsize\ Dummy_i = \alpha + \beta_1 Resi\ Demand_i \times High\ Q_i + \beta_2 Resi\ Demand_i \times Mid\ Q_i + \varphi_1\ High\ Q_{i_i} +$$
$$\varphi_2\ Mid\ Q_i + \pi Resi\ Demand_i + \theta_1 Bond\ Char_i + \theta_2 Issuer\ Char_i + FE + u_i, \quad (4)$$

where i indexes a bond offering. *High Q*, *Mid Q*, and *Low Q* (the omitted group) equals one for observations that rank at the top, medium, and bottom tercile in the yearly distribution of *Tobin's Q*, and zero otherwise. All other specifications are the same as in equation (3), except that we do not include *Tobin's Q* as a control variable.

Results presented in column (6) of Table 5 do not support that firms with greater investment opportunities respond more aggressively to realizations of investor demand by upsizing. In fact, it is the opposite – their upsizing decision exhibits the smallest sensitivity to realizations of investor demand. A possible explanation is that firms with high Tobin's Q are less financially constrained than other companies.

6. Financing and Investment in Response to Credit Supply

6.1 Upsizing and Changes in Capital Structure

A primary concern associated with easy credit conditions is that firms may take on excessive levels of debt, increasing the likelihood of future defaults. To shed light on this issue, we examine how firms use the additional proceeds from upsized offerings, conditional on their decision to upsize. Note that we do not suggest that upsizing exogenously *causes* a firm to change its policies. Rather, our findings should be interpreted as upsizing allows a firm to implement policy changes that would not have been possible without the extra proceeds.

We first investigate whether firms use additional proceeds to substitute for other types of external financing, such as bank debt and equity (Schwert, 2020; Zhu, 2021), to increase cash holdings, or to increase payouts. Except when proceeds are used to refinance other debt, upsizing leads to an increase in leverage. We employ a continuous DID framework. For each firm that issues bonds during a quarter, we obtain firm characteristics from Capital IQ for the nine-quarter window centered around the issuance quarter. Our specification compares the post-issuance changes in firm outcomes for issuers who upsize offerings to other (non-upsizing) issuers.

A potential concern is that firm characteristics of issuers who upsize may be different from those who do not, leading to differences in the use of proceeds. To address this issue, we employ the "overlap weighting" approach, introduced by Li et al. (2018) and used by Bartram et al. (2021). This method assigns an overlap weight, defined below, to each sample observation to generate a balanced sample of upsizing and non-upsizing issuers with similar distributions of firm- and market-condition-covariates, allowing us to study the impact of upsizing on a group of issuers with similar observable characteristics. Using this method to address the selection bias is particularly suitable when the treated group is the minority in the sample.[13]

To calculate the overlap weight, we first use issuer-quarter observations as of the quarter before the offering event (quarter -1) to predict the probability of upsizing at quarter 0, using firm characteristics and market conditions included in equation (4).[14] For each offering event j, the predicted probability of issuer i to upsize the offering in quarter 0 is p_{ij}. The overlap weight (w_{ij}) for upsizing issuers is 1-p_{ij}, whereas that for non-upsizing issuers is p_{ij}. The intuition of this

[13] For a more detailed discussion of the overlap weighting method and its advantages compared to propensity score matching, inverse probability weighting, and other methods to balance the covariates of treated and nontreated samples, see Section 5 of Bartram et al. (2021).

[14] When firm characteristics are missing at quarter -1, we trace back the previous three quarters until we find non-missing values. Results are similar when we use NEIO or HYS to measure credit market conditions.

weighting method is to increase the representativeness of issuers that have a high estimated probability of upsizing but do not upsize, as well as the representativeness of issuers that do not have a high probability of upsizing but do so. Thus, after applying the overlap weights, upsizing issuers and non-upsizing issuers in the balanced sample have similar observable characteristics. Table C5 of Appendix C presents the differences in firm characteristics and market conditions before the offering event of upsizing versus non-upsizing issuers, before and after weighting, confirming that covariates are not statistically different between the treated and control groups after weighting.

Next, we use the balanced sample to estimate the following DID model:

$$Outcome_{ijt} = \alpha + \sum_{q=-4}^{q=4} \beta_q \, Quarter_q + \sum_{q=-4}^{q=4} \gamma_q \, Quarter_q \times Upsized\ Amount_j + \delta Upsized\ Amount_j + \theta Controls_{ijt} + Group\ FE + Time\ FE + u_{ijt}, \quad (5)$$

where i indexes issuers, j indexes offering events, and t indexes calendar quarters. Outcome is one of the following variables: *Bank Debt, Cash Holdings, Net Equity Issuance, Payout Ratio,* and *Leverage Ratio. Quarter* includes nine dummy variables indicating the quarter relative to the offering quarter (quarter 0), with quarter -4 being the omitted benchmark quarter. When a firm has multiple bond offerings within a quarter, *Upsized Amount* is calculated as the total dollar upsized amount of all offerings, scaled by the firm's total assets in quarter 0, and is assigned to all nine quarterly observations around an offering event. Other issuer-level controls are as in equation (1), excluding *Leverage Ratio*. *Group FE* includes either firm fixed effects or issue-cohort fixed effects. An issue-cohort includes the nine quarterly observations of an issuer surrounding the offering quarter for each issuer-offering event, j. Allowing the fixed effects to vary by issue-cohort is more conservative than forcing them to be the same across cohorts for the same issuer (Gormley and Matsa, 2016). *Time FE* includes year-quarter fixed effects and controls for any time-series

variation common to both groups. We estimate the equation using weighted OLS, with the weight of w_{ij} as defined above, and cluster the robust standard errors by issuer.

Table 6 reports the estimation results. Odd columns include issuer fixed effects. Even columns include the issue-cohort fixed effects, making the independent variable *Upsized Amount* drop out because it does not vary within an issue-cohort. In Figure 4, we plot the coefficients of the interaction terms between quarter dummies and *Upsized Amount* from odd columns.

Panel A of Table 6 shows that IG issuers use the upsized amount to reduce bank debt and increase cash. In column (1), for each $1 of additional capital raised through upsizing, the bank debt of upsizing issuers is $0.552, $0.624, $0.586, $0.631, and $0.550 lower in quarters 0, 1, 2, 3, and 4 than in quarter -4, respectively, compared to non-upsizing issuers. All of these differences are statistically significant. In contrast, there is no significant difference between the upsizing and non-upsizing issuers before quarter 0, suggesting that these issuers have parallel trends before the offering event. These results echo Becker and Ivashina (2014), Darmouni and Siani (2022), and Zhu (2021), among others, showing that firms use proceeds from bond offerings to substitute away from bank debt. Upsizing also leads to an increase in the cash holdings of IG issuers, but the increase declines both economically and statistically after issuance. We do not find a significant difference in net equity issuance or payouts for the upsizing and non-upsizing issuers before and after the offering quarter.

We also find that upsizing leads to an increase in the leverage ratio (total debt/assets) of IG issuers. Column (9) shows that for each 1% of asset value raised through upsizing, the leverage ratio of upsizing issuers is 0.732%, 0.702%, 0.817%, 0.598%, and 0.591% higher in quarters 0, 1, 2, 3, and 4 than in quarter -4, respectively, compared to non-upsizing issuers. The increase in total

leverage declines both economically and statistically with time, consistent with the repayment of bank debt and the observed changes in cash holdings.

For HY bonds, Panel B of Table 6 shows that upsizing issuers also reduce bank debt after the offering compared to non-upsizing issuers. Upsizing HY issuers also increase their cash holdings compared with non-upsizing issuers, but the increase declines and becomes insignificant after 4 quarters post-issuance. These results echo recent studies that find patterns of corporate cash stockpiling (e.g., Huang and Ritter, 2021; Denis and McKoen, 2021).[15] We again find no differences in net equity issuance or payouts before and after the offering quarter. Unlike IG issuers, the resulting increase in the leverage ratio of HY upsizing issuers becomes statistically insignificant by quarter 4, suggesting that the effect of credit supply on their leverage is temporary.[16]

We conduct four sets of robustness tests for these results (not reported for brevity). First, we re-estimate equation (6) excluding offering events where the firm has issued another bond in the 8 quarters preceding the offering, yielding similar results. Second, our baseline results compare upsizing to non-upsizing firms, but the non-upsizing group includes some firms that do not experience positive realizations of credit supply. We therefore re-estimate our results using only firms that appear to have received positive realizations of credit supply, specifically, firms that have either upsized or have decreased their offering yield. The other two sets of robustness tests are similar to Section 4.1, using a subsample of public firms, and with robust standard errors clustered by issuer and time (either year or year-quarter levels). Our conclusions remain that the

[15] Denis and McKeon (2021) show that high cash holdings after issuance are transitory and quickly depleted by subsequent negative cash flows/funding needs, resulting in substantial intra-firm variation in cash within a year.
[16] All the results in this section are similar using *unweighted* OLS, except that the increase in leverage is temporary for both IG and HY firms.

additional capital raised mainly changes the composition of debt, and HY issuers do not use the upsizing opportunity to permanently increase leverage.

6.2 Upsizing and Investment

Finally, we use our balanced sample to study whether firms adjust their investment policy after taking additional bond proceeds. Because investment may not be smoothly distributed over time, changes in investment after upsizing, if any, may not be distributed evenly in the quarters post-issuance. Thus, when studying the effects of upsizing on investment, we group firm-quarter observations into pre- and post-issuance quarters and estimate the following model:

$$Capex_{ijt} = \alpha + \beta Post\ Issue_{ijt} + \gamma Post\ Issue_{ijt} \times Upsized\ Amount_j + \delta Upsized\ Amount_j + \theta Controls_{ijt} + Group\ FE + Time\ FE + u_{ijt}, \quad (6)$$

where i indexes issuers, j indexes offering events, and t indexes calendar quarters. Capex is capital expenditures scaled by firm total assets. *Post Issue* equals one for the offering quarter and the subsequent 4 quarters, and zero otherwise. All other model specifications are the same as equation (5), except that we include a triple interaction term of *Post Issue*, *Upsized Amount*, and *Tobin's Q* to allow the effects of upsizing to vary across firms with different growth opportunities.

Columns (1) to (4) of Table 7 present the estimation results for IG issuers. The results suggest that upsizing does not significantly impact the investment of IG issuers, regardless of their growth opportunities. These results are not surprising considering that IG issuers are less financially constrained, so their investment is likely to be less sensitive to credit supply conditions.

Columns (5) to (8) of Table 7 present the estimation results for HY issuers. The results suggest that upsizing does not significantly impact investment on average. However, HY issuers with higher growth opportunities are more likely to increase investment after their bond offerings are upsized. Results in column (7) suggest that when the upsized amount accounts for 3% of total

assets (the average upsized amount/assets for upsized HY issuers), a one standard deviation (0.6) increase in Tobin's Q is associated with a 0.279% (0.031*0.03*0.6*5 quarters) increase in the total capital expenditures in the five post-offering quarters, which is 9.96% of the sample standard deviation of capital expenditures (2.8%). Similar to Section 7.1, we conduct four sets of robustness tests by excluding offering events when the firm has issued another bond in the 8 quarters preceding the offering, comparing upsizing issuers with non-upsizing issuers that decrease their offering yield, using the subsample of public firms, and with robust standard errors clustered by issuer and time (either year or year-quarter levels). We do not find evidence that upsizing issuers overinvest compared to non-upsizing issuers.

7. Conclusions

In this paper, we study firms' response to the supply of credit observed in the few hours when investors' primary market orders are taken to build the "book", but during which firms' fundamentals and demand for capital remain unchanged. In response to strong realizations of investor demand, we find that increasing the quantity offered – upsizing – is common and significantly increases the dollar proceeds to issuing firms. However, many offerings remain highly oversubscribed, indicating that firms do not increase the amount of debt they issue to match the full credit supply available.

We show that credit supply at the security level significantly varies with credit market conditions. Yet, it is the unexpected component of security-level credit supply that drives the upsizing decision. Furthermore, issuers' response to the unexpected component of investor demand varies with firms' degree of financial constraints: those which appear more financially constrained are more likely to upsize when the realized credit supply is strong. Our setting enables

us to study firms' debt-raising decisions independent of significant changes in investment opportunities that accompany credit cycles.

Lastly, we examine firms' post-offering capital structure and investment decisions. Both IG and HY firms use the additional proceeds from upsizing to reduce bank debt and increase cash holdings. Increases in leverage fade slowly for IG issuers and are temporary for HY issuers. We do not find evidence consistent with overinvestment when firms receive large additional proceeds from strong realized credit supply; only HY issuers with higher growth opportunities use the additional capital from upsizing to increase capital expenditures. Our findings imply that the larger gross quantities of debt raised by companies during credit booms due to high levels of investor demand are not necessarily associated with excessive leverage or overinvestment for firms with the greatest risk of default. Rather, the firm-level behavior we observe is consistent with Graham (2022), stressing the value of financial flexibility and other factors that limit firms' net increases in borrowing, even during credit booms.

References

Albuquerque, R., Cardoso-Costa, C., and Faias, J., 2022. Price-elasticity of demand and risk bearing capacity in sovereign bond auctions. *Working paper*.

Altman, E. I., Hotchkiss, E., and Wang, W., 2019. *Corporate Financial Distress, Restructuring, and Bankruptcy: Analyze Leveraged Finance, Distressed Debt, and Bankruptcy*, 4th Edition.

Axelson, U., Jenkinson, T., Strömberg, P. and Weisbach, M.S., 2013. Borrow cheap, buy high? The determinants of leverage and pricing in buyouts. *Journal of Finance*, 68, 2223-2267.

Baker, M., and Wurgler, J., 2002. Market Timing and Capital Structure. *Journal of Finance*, 57, 1-32.

Bartram, S., Conrad, J., Lee, J. and Subrahmanyam, M., 2021. Credit default swaps around the world. *Review of Financial Studies*, 35, 2464-2524.

Becker, B. and Ivashina, V., 2014. Cyclicality of credit supply: Firm level evidence. *Journal of Monetary Economics*, 62, 76-93.

Becker, B., and Ivashina, V., 2015. Reaching for yield in the bond market. *Journal of Finance*, 70, 1863-1902.

Benveniste, L., and Spindt, P, 1989. How investment bankers determine the offer price and allocation of new issues. *Journal of Financial Economics*, 24, 343-361.

Ben-Rephael, A., Choi, J., and Goldstein, I., 2021. Mutual fund flows and fluctuations in credit and business cycles. *Journal of Financial Economics,* 139, 84-108.

Bessembinder, H., Jacobsen, S., Maxwell, W., and Venkataraman, K., 2022. Overallocation and secondary market outcomes in corporate bond offerings. *Journal of Financial Economics*, 146, 444-474.

Bodnaruk, A. and Rossi, M., 2021. Shareholders as creditors of first resort. *Management Science*, 67,1737-1757.

Chernenko, S., and Sunderam, A., 2012. The real consequences of market segmentation. *Review of Financial Studies*, 25, 2041-2069.

Choi, J., and Kronlund, M., 2018. Reaching for yield in corporate bond mutual funds. *Review of Financial Studies,* 31, 1930-1965.

Crouzet, N., and Mehrotra, N.R., 2020. Small and large firms over the business cycle. *American Economic Review,* 110, 3549-3601.

Darmouni, O., and Siani, K., 2022. Bond market stimulus: Firm-level evidence from 2020-21. CEPR Discussion Paper No. DP17191.

DeAngelo, H. and DeAngelo, L., 2007. Capital structure, payout policy, and financial flexibility. *Working Paper*.

DeAngelo, H., Gonçalves, A.S. and Stulz, R.M., 2018. Corporate deleveraging and financial flexibility. *Review of Financial Studies*, 31, 3122-3174.

Denis, D.J., 2011. Financial flexibility and corporate liquidity. *Journal of Corporate Finance*, 17, 667-674.

Denis, D.J., and McKeon, S.B., 2021. Persistent negative cash flows, staged financing, and the stockpiling of cash balances. *Journal of Financial Economics*, 142, 293-313.

Denis, D.J. and McKeon, S.B., 2012. Debt financing and financial flexibility evidence from proactive leverage increases. *Review of Financial Studies*, 25, 1897-1929.

Erel, I., Julio, B., Kim, W., and Weisbach, M. S., 2012. Macroeconomic conditions and capital raising. *Review of Financial Studies, 25*(2), 341-376.

Fahlenbrach, R., Rageth, K. and Stulz, R.M., 2021. How valuable is financial flexibility when revenue stops? Evidence from the COVID-19 crisis. *Review of Financial Studies*, 34, 5474-5521.

Farre-Mensa, J., and Ljungqvist, A. (2016). Do measures of financial constraints measure financial constraints? *Review of Financial Studies*, 29(2), 271–308.

Farre-Mensa, J., Ljungqvist, A., and Schroth, E., 2022. How Prevalent Are Financial Constraints in the US? Swedish House of Finance Research Paper No. 22-05.

Feldstein, Sylvan G., and Frank J. Fabozzi, 2008. *The Handbook of Municipal Bonds*. 155. John Wiley & Sons.

Gertler, M. and Lown, C.S., 1999. The information in the high-yield bond spread for the business cycle: evidence and some implications. *Oxford Review of economic policy, 15*(3), 132-150.

Gilchrist, S., and Zakrajšek, E., 2012. Credit spread and business cycle fluctuations. *American Economic Review*, 102, 1692-1720.

Goldstein, M., Hotchkiss, E., and Nikolova, S., 2021. Dealer behavior and the trading of newly issued corporate bonds. *Working Paper.*

Gormley, T., and Matsa, D., 2016. Playing it safe? Managerial preferences, risk, and agency conflicts. *Journal of Financial Economics*, 122, 431-455.

Graham, J., 2022. Presidential address: Corporate finance and reality. *Journal of Finance*, 77(4), 1975-2049.

Graham, J. and Harvey, C., 2001. The theory and practice of corporate finance: Evidence from the field. *Journal of Financial Economics*, 60, 187-243.

Grennan, J., and Musto, D., 2018. Who benefits from bond market modernization? *Working paper*.

Greenwood, R., and Hanson, S.G., 2013. Issuer quality and corporate bond returns. *Review of Financial Studies*, 26, 1483-1525.

Greenwood, R., Hanson, S.G., Shleifer, A., and Sørensen, J.A., 2022. Predictable Financial Crisis. *Journal of Finance*, 77, 863-921.

Hadlock, C. J., and Pierce, J. R. (2010). New evidence on measuring financial constraints: Moving beyond the KZ index. *Review of Financial Studies*, 23(5), 1909–1940.

Holmstrom, B. and Tirole, J., 1997. Financial intermediation, loanable funds, and the real sector. *Quarterly Journal of Economics*, 112, 663-691.

Huang, R., and Ritter, J. R., 2021. Corporate cash shortfalls and financing decisions. *Review of Financial Studies*, 34, 1789-1833.

Kiyotaki, N. and Moore, J., 1997. Credit cycles. *Journal of Political Economy*, 105, 211-248.

Lemmon, M., and Roberts, M., 2010. The response of corporate financing and investment to changes in the supply of credit. *Journal of Financial and Quantitative Analysis*, 45, 555–587.

Li, F., Morgan, K.L. and Zaslavsky, A.M., 2018. Balancing covariates via propensity score weighting. *Journal of the American Statistical Association*, 113, 390-400.

López-Salido, D., Stein, J., and Zakrajšek, E., 2017. Credit-market sentiment and the business cycle. *Quarterly Journal of Economics* 132, 1373-1426.

Ma, Y., 2019. Nonfinancial firms as cross-market arbitrageurs. *Journal of Finance*, 74, 3041-3087.

Nikolova, S., Wang, L. and Wu, J.J., 2020. Institutional allocations in the primary market for corporate bonds. *Journal of Financial Economics*, 137, 470-490.

Schwert, M., 2020. Does borrowing from banks cost more than borrowing from the market? *Journal of Finance*, 75, 905-947.

Siani, K., 2022. Raising bond capital in segmented markets. *Working paper.*

Stein, J.C., 2014. Incorporating Financial Stability Consideratings into a Monetary Policy Framework. *At the International Research Forum on Monetary Policy*.

Wang, L., 2021. Lifting the veil: the price formation of corporate bond offerings. *Journal of Financial Economics,* 142, 1340-1358.

Whited, T. M., and Wu, G. (2006). Financial constraints risk. *Review of Financial Studies*, 19(2), 531–559.

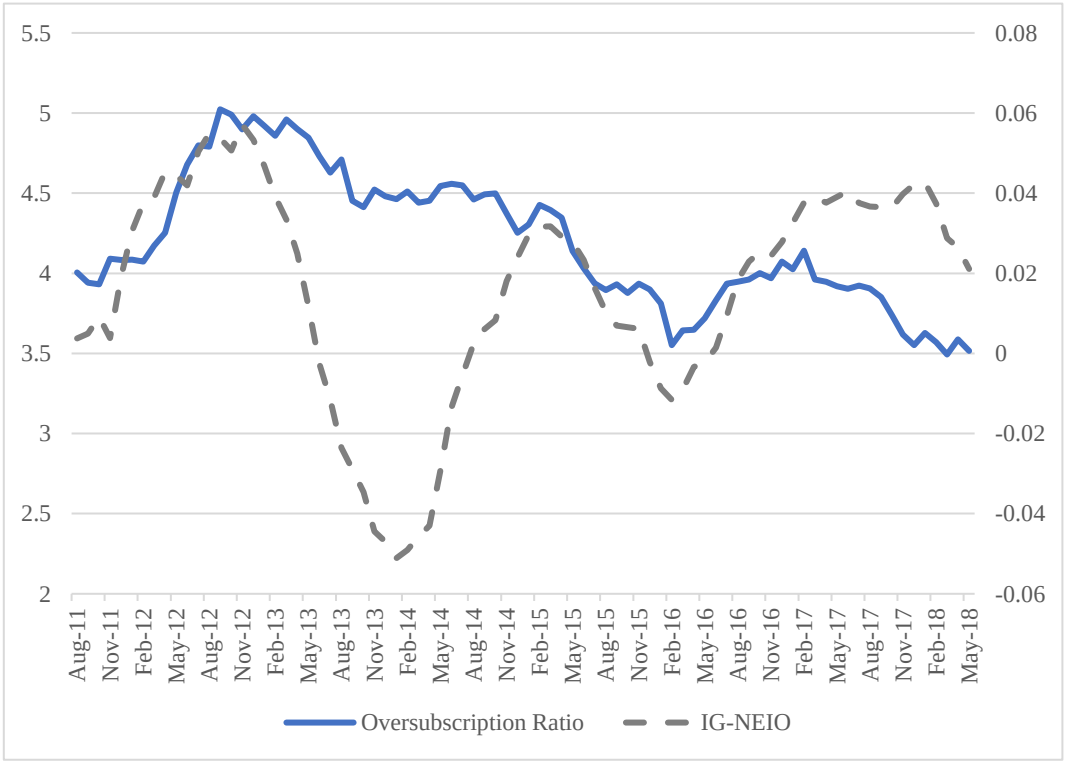
Zhu, Q., 2021. Capital supply and corporate bond issuances: evidence from mutual fund flows. *Journal of Financial Economics,* 141, 551-572.

Zhang, D., Zhang, Y. and Zhao, Y.E., 2022. Lending relationships and the pricing of syndicated loans. *Management Science*, forthcoming.

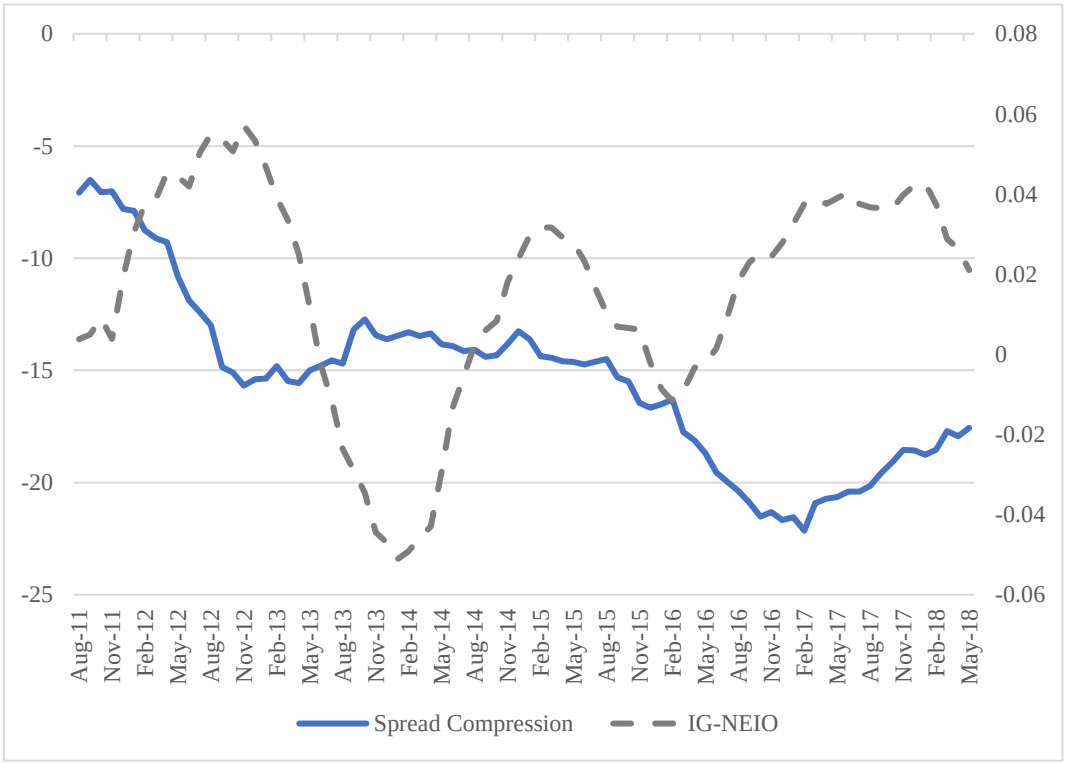
Figure 1. Investor Demand and NEIO

This figure plots the *Oversubscription Ratio* and *Spread Compression* for the subsample of IG and HY bonds issued between September 2010 and May 2018 with available order book size data and/or initial spread information. The *Oversubscription Ratio* of an offering is its order book size scaled by the initial offering amount (with a unit of 1). *Spread Compression* is the difference between the final and the initially proposed offering yield in bps. For purposes of these figures, we plot monthly observations of the moving average of the past 12 months. Panel A shows the *Oversubscription Ratio* (on the left axis) plotted against *IG-NEIO* (on the right axis). Panels B and C show *Spread Compression* (on the left axis) plotted against IG-NEIO and HY-NEIO (on the right axis) for the IG and HY sectors, respectively.

Panel A. Oversubscription Ratio and NEIO -- IG



Panel B. Spread Compression and NEIO -- IG



Panel C. Spread Compression and NEIO -- HY

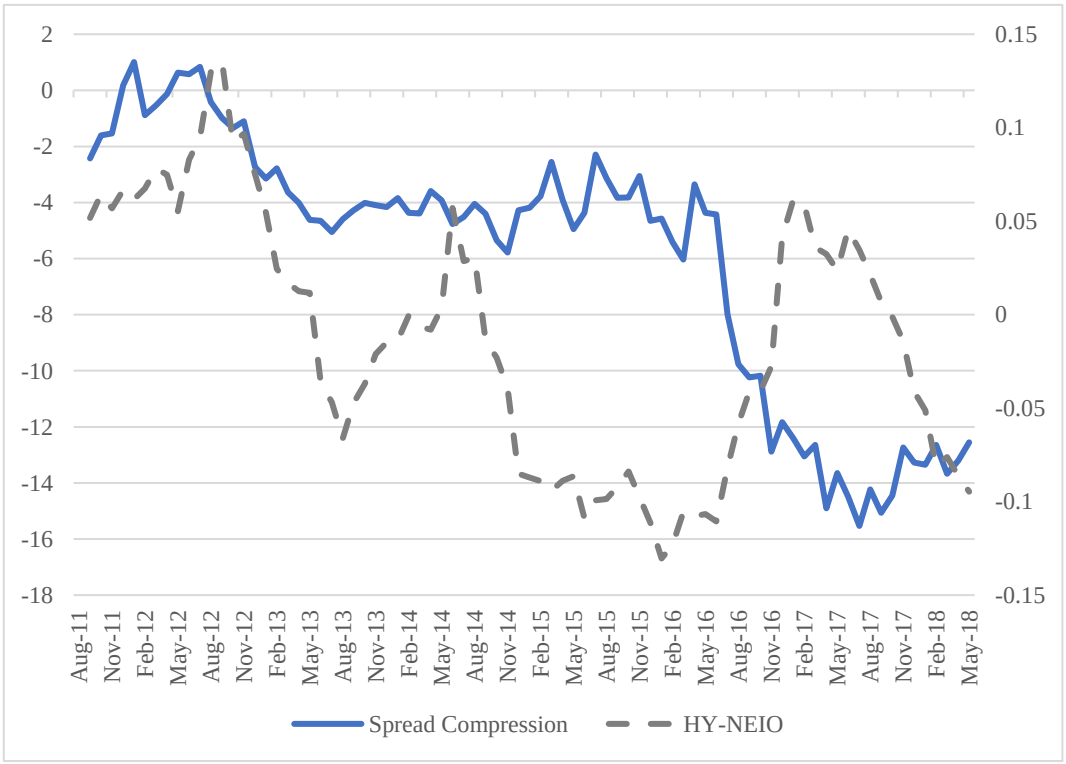
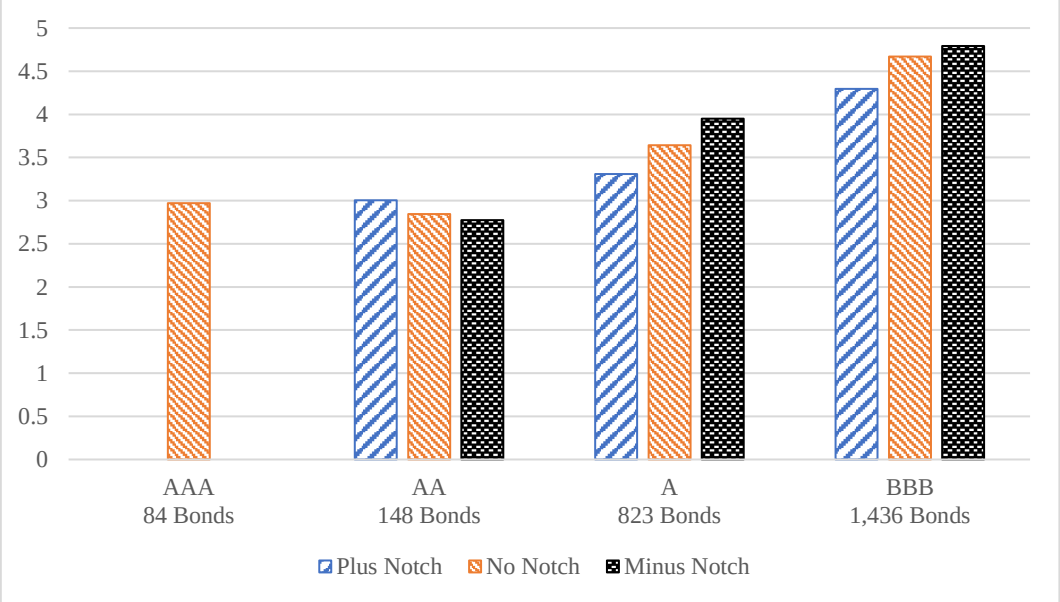


Figure 2 Investor Demand by Rating Notches

This figure displays within each letter rating category the average *Oversubscription Ratio* and *Spread Compression* of *Plus*, *No*, and *Minus Notch* offerings, which carry a "+", no, or "-" sign after the rating letters, respectively. Panel A shows the average *Oversubscription Ratio* in the IG sector, and Panel B shows the average *Spread Compression* for both IG and HY bonds. The sample period is between September 2010 and May 2018.

Panel A. Oversubscription Ratio



Panel B. Spread Compression

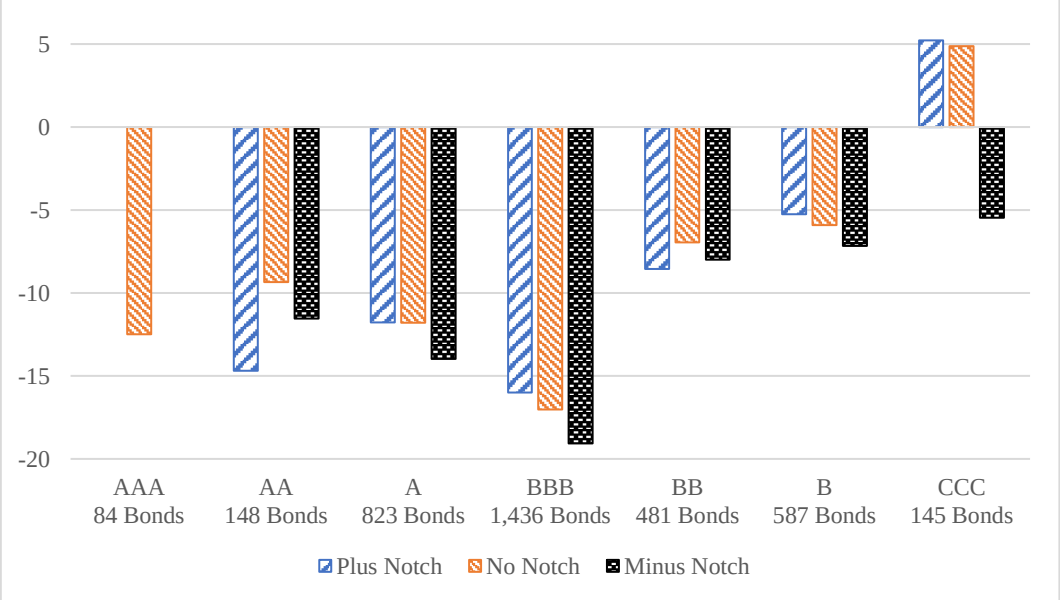
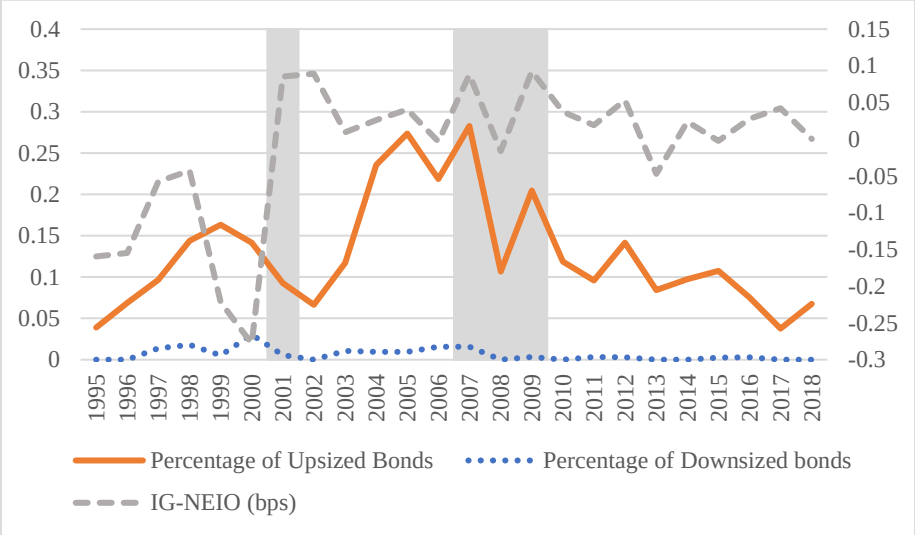


Figure 3. Upsizing and Credit Supply

This figure plots the yearly percentage of upsized and downsized bond offerings (on the left axis) and the annual average of monthly *NEIO* (the value of intra-family net exchanges for investment-grade (IG) and high-yield (HY) corporate bond mutual funds, scaled by total net fund assets; on the right axis). Panel A is for IG offerings, and Panel B is for HY offerings. Shaded years, 2001 and 2007-2009, are those that include NBER recession periods. The sample includes 8,676 corporate bonds issued between 1995 and May 2018.

Panel A. IG



Panel B. HY

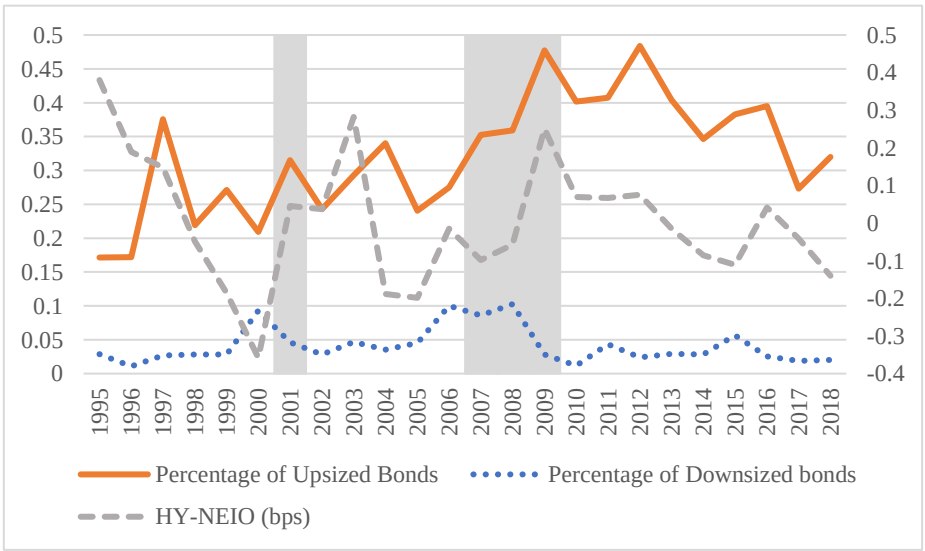


Figure 4. Corporate Policy Changes around the Offering Event

This figure presents the changes in issuers' financing and payout policies during the nine quarters around the upsized offering event, relative to non-upsizing issuers. Plots show the coefficients of *Quarter* × *Upsized Amount* from the following equation:

$$Outcome_{i,t} = \alpha + \sum_{q=-4}^{q=4} \beta_q \, Quarter_q + \sum_{q=-4}^{q=4} \gamma_q \, Quarter_q \times Upsized\ Amount_i + \delta Upsized\ Amount_i + \theta\, Controls_{i,t} + Issuer\ FE + Time\ FE + u_{i,t}\ .$$

Outcome is one of the following variables: *Bank Debt Amount*, *Net Equity Issuance*, *Payout Ratio*, *Cash Holdings*, and *Leverage Ratio*. *Quarter* includes nine dummy variables indicating the quarter relative to the offering quarter (Q0), with quarter -4 being the omitted benchmark quarter. Solid lines are for IG issuers, and dashed lines are for HY issuers. The whiskers show 90% confidence intervals.

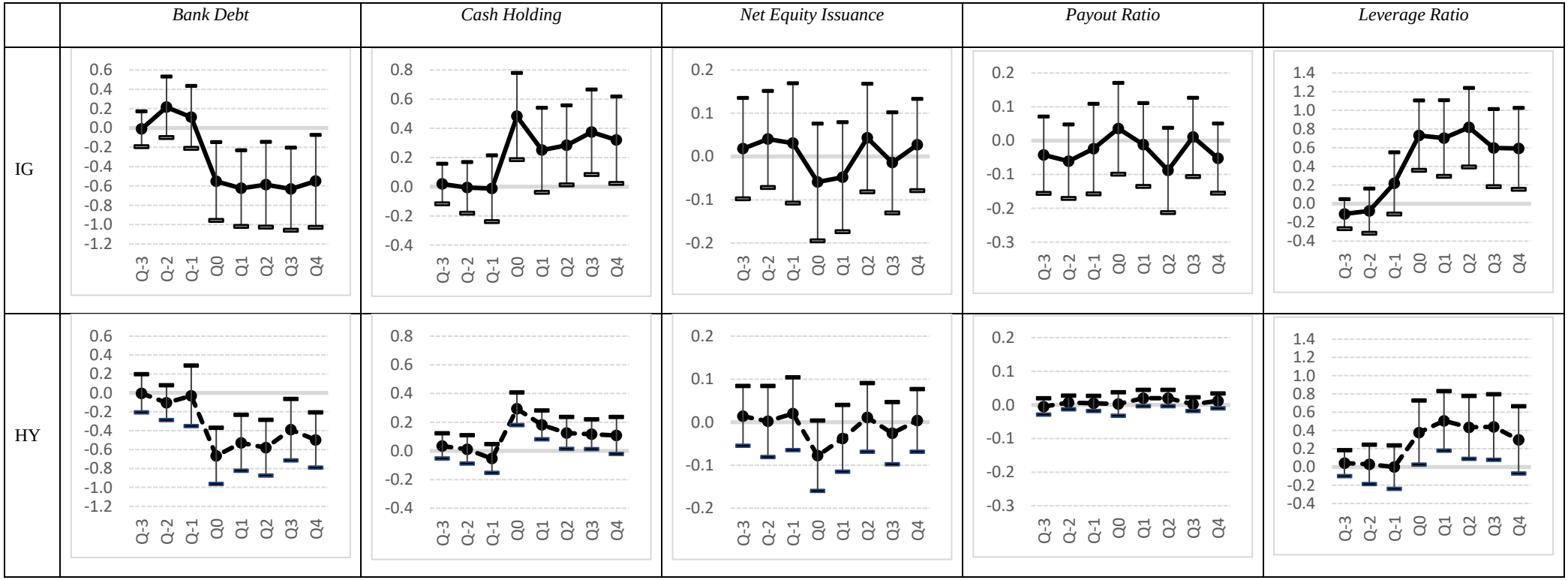


Table 1. Summary Statistics

This table presents the summary statistics of bond and issuer characteristics for investment-grade (IG) and high-yield (HY) bonds. All variables are at the bond level except those for tests of financing and investment outcomes, which are at the firm-quarter level. All continuous variables are winsorized at 1% and 99%. Appendix B contains variable definitions. The sample includes 8,676 corporate bonds issued between 1995 and May 2018.

	IG			HY		
	N	Mean	Std Dev	N	Mean	Std Dev
Primary market Variables:						
Initial Offering Amount	5,388	632.319	514.405	3,288	367.143	297.657
Final Offering Amount	5,388	650.389	524.724	3,288	406.830	337.914
Upsize Dummy	5,388	0.117	0.321	3,288	0.343	0.475
Upsize Magnitude	5,388	0.038	0.129	3,288	0.098	0.199
Upsize Magnitude (upsized	628	0.331	0.212	1,129	0.299	0.229
Oversubscription Ratio	2,491	4.133	2.169			
Spread Compression (bps)	2,491	-15.273	11.469	1,213	-5.498	22.992
Bond Characteristics:						
Maturity (years)	5,388	13.336	11.858	3,288	8.631	2.589
Rule 144A Dummy	5,388	0.063	0.243	3,288	0.694	0.461
First Offering Dummy	5,388	0.095	0.294	3,288	0.249	0.433
Credit Rating	5,388	3.439	0.720	3,288	5.751	0.629
Minus Notch	5,388	0.310	0.463	3,288	0.358	0.480
Firm Characteristics:						
Tobin's Q	5,388	2.055	0.974	3,288	1.494	0.633
Return on Assets	5,388	0.072	0.057	3,288	0.011	0.082
Book Leverage	5,388	0.286	0.147	3,288	0.457	0.226
Log(Sales)	5,388	9.466	1.349	3,288	7.364	1.416
Outstanding Bank Loan	5,388	0.906	0.292	3,288	0.866	0.341
WW Index	5,282	-0.485	0.067	3,039	-0.371	0.073
HP Index	5,308	-4.327	0.421	3,075	-3.842	0.510
Financing and Investment Outcomes:						
Bank Debt	17,862	0.022	0.048	15,175	0.130	0.150
Cash Holding	27,944	0.074	0.096	25,438	0.066	0.081
Leverage Ratio	27,944	0.315	0.141	25,438	0.492	0.241
Net Equity Issuance	27,944	-0.007	0.016	25,438	0.004	0.029
Payout Ratio	27,944	0.015	0.018	25,438	0.005	0.013
Capex	27,944	0.015	0.014	25,437	0.020	0.028

Table 2. Upsizing, Spread Compression, and Realized Demand – Univariate Results

This table presents the relation between upsizing, spread compression, and realized investor demand, measured by the *Oversubscription Ratio*, for the subsample of IG bonds issued between September 2010 and May 2018 with available order book size data and initial spread information. Variables are as defined in Appendix B.

	Oversubscription Ratio			
	<=1.5	(1.5, 3]	(3, 4.5]	>4.5
All				
Number of offerings	66	900	691	834
% with spread tightened	66.7%	83.0%	96.5%	98.2%
Average spread compression	-3.34	-9.42	-15.45	-22.38
Average spread compression when tightened	-10.16	-12.40	-16.33	-22.97
% upsized	0.0%	4.2%	7.7%	15.8%
Average upsizing magnitude	-0.47%	0.86%	2.21%	4.86%
Average upsizing magnitude when upsized	0%	20.80%	28.78%	30.72%
AAA/AA/A				
Number of offerings	36	495	320	204
% with spread tightened	83.3%	87.1%	98.1%	99.5%
Average spread compression	-7.97	-9.12	-14.17	-18.62
Average spread compression when tightened	-10.07	-10.99	-14.52	-18.71
% upsized	0.0%	2.8%	5.6%	11.3%
Average upsizing magnitude	0%	0.44%	1.27%	3.68%
Average upsizing magnitude when upsized	0%	15.53%	22.60%	32.63%
BBB				
Number of offerings	30	405	371	630
% with spread tightened	46.7%	78.0%	95.1%	97.8%
Average spread compression	2.21	-9.79	-16.56	-23.60
Average spread compression when tightened	-10.36	-14.31	-17.93	-24.38
% upsized	0.0%	5.9%	9.4%	17.3%
Average upsizing magnitude	-1.03%	1.38%	3.02%	5.25%
Average upsizing magnitude when upsized	0%	23.87%	31.97%	30.32%

Table 3. Investor Demand and Credit Market Conditions

This table provides OLS regressions explaining *Oversubscription Ratio* and *Spread Compression*, for the subsample of IG bonds issued between September 2010 and May 2018 with initial spread information and/or book size information. The dependent variable in columns (1) and (2) is *Oversubscription Ratio* and in columns (1)-(4) is *Spread Compression*. All variables are defined in Appendix B. Robust standard errors clustered at the issuer level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 3. Investor Demand and Credit Market Conditions -- Continued

	IG				HY	
	Oversubscription Ratio		Spread Compression		Spread Compression	
	(1)	(2)	(3)	(4)	(5)	(6)
IG-/HY-NEIO	2.658*	2.600*	-19.626**	-19.436**	-11.916***	-11.637***
	(1.544)	(1.561)	(9.293)	(9.390)	(4.303)	(4.457)
HYS	-1.365	-1.344	10.400*	8.105	3.708	1.972
	(1.062)	(1.048)	(5.537)	(5.585)	(10.595)	(10.629)
Excess Bond Premium	0.615**	0.637**	-4.960***	-5.220***	8.539	8.555
	(0.288)	(0.286)	(1.774)	(1.798)	(5.492)	(5.686)
Treasury Rate	-0.433**	-0.304	-0.049	-0.631	-1.740	-1.630
	(0.183)	(0.185)	(0.957)	(0.980)	(2.745)	(2.746)
Treasury Slope	-0.291**	-0.224*	3.627***	1.811**	3.237**	3.185**
	(0.134)	(0.135)	(0.765)	(0.859)	(1.509)	(1.535)
T-bill Forecast Dispersion	-4.587***	-3.851***	1.365	3.728	-25.092	-23.060
	(1.369)	(1.383)	(7.292)	(7.321)	(20.889)	(21.970)
Prior Oversubscription		0.199**				
		(0.079)				
Prior Spread Compression				0.395***		0.068
				(0.073)		(0.129)
Minus Notch	0.246*	0.249*	-1.515**	-1.474**	-1.796	-1.664
	(0.135)	(0.135)	(0.738)	(0.734)	(1.400)	(1.409)
Log(Initial Offering Amount)	-1.142***	-1.154***	0.331	0.546	2.303	2.442
	(0.113)	(0.112)	(0.599)	(0.600)	(1.856)	(1.879)
Log(Maturity)	0.111**	0.105**	0.451	0.492*	-2.205	-2.309
	(0.052)	(0.052)	(0.275)	(0.269)	(2.792)	(2.811)
Rule 144A Dummy	-0.258	-0.263	0.233	0.122	0.112	0.177
	(0.307)	(0.309)	(1.852)	(1.874)	(1.270)	(1.273)
First Offering Dummy	0.547*	0.598**	-0.343	-1.132	6.136**	5.980**
	(0.300)	(0.299)	(1.596)	(1.590)	(2.387)	(2.397)
Tobin's Q	0.011	0.022	-0.135	-0.047	-2.232*	-2.304*
	(0.078)	(0.078)	(0.466)	(0.431)	(1.284)	(1.290)
Return on Assets	1.200	1.099	-4.956	-8.077	-14.452	-14.151
	(1.672)	(1.648)	(9.877)	(9.729)	(12.143)	(12.176)
Book Leverage	-1.554***	-1.519***	4.224*	4.877**	2.126	2.063
	(0.467)	(0.459)	(2.251)	(2.204)	(3.957)	(3.987)
Log(Sales)	-0.133*	-0.135*	1.209***	1.237***	-0.318	-0.329
	(0.076)	(0.077)	(0.436)	(0.435)	(0.753)	(0.763)
Outstanding Bank Loan Dummy	-0.129	-0.122	0.749	0.500	-3.885	-3.826
	(0.242)	(0.241)	(1.093)	(1.099)	(2.873)	(2.882)
Rating FEs	Yes	Yes	Yes	Yes	Yes	Yes
Industry (FF-12) FEs	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,491	2,481	2,491	2,481	1,213	1,209
R-squared	0.252	0.257	0.182	0.203	0.087	0.088

Table 4. Upsizing and Unexpected Credit Supply

This table shows the relationship between upsizing and unexpected credit supply. The dependent variable in this table is *Upsize Dummy*. *Resi Demand -- Oversubscription (Spread Compr.)* is the residual term (the negative value of the residual term) from estimating equation (1) without controlling NEIO, where the dependent variable is *Oversubscription Ratio (Spread Compression).* Even-numbered columns control for *Prior Demand* when predicting *Resi Demand,* whereas odd-numbered columns do not. All other variables are defined in Appendix B. Robust standard errors obtained from bootstrapping the two-stage regressions 1,000 times are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	IG				HY	
	(1)	(2)	(3)	(4)	(5)	(6)
Resi Demand -- Oversubscription	0.011***	0.012***				
	(0.004)	(0.004)				
Resi Demand – Spread Compr.			0.002***	0.002***	0.002***	0.002***
			(0.001)	(0.001)	(0.001)	(0.001)
Minus Notch	-0.020	-0.020	-0.020	-0.019	-0.001	0.001
	(0.014)	(0.014)	(0.014)	(0.014)	(0.032)	(0.033)
Log(Initial Offering Amount)	-0.127***	-0.128***	-0.127***	-0.128***	-0.020	-0.019
	(0.012)	(0.011)	(0.011)	(0.011)	(0.033)	(0.032)
Log(Maturity)	0.008	0.008	0.008	0.008	-0.069	-0.069
	(0.007)	(0.007)	(0.006)	(0.006)	(0.060)	(0.059)
Rule 144A Dummy	-0.020	-0.020	-0.020	-0.021	-0.047	-0.044
	(0.026)	(0.029)	(0.028)	(0.028)	(0.034)	(0.034)
First Offering Dummy	0.012	0.013	0.011	0.013	-0.017	-0.020
	(0.027)	(0.028)	(0.027)	(0.027)	(0.039)	(0.038)
Tobin's Q	0.004	0.004	0.005	0.005	0.058**	0.058***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.023)	(0.022)
Return on Assets	-0.110	-0.115	-0.125	-0.125	-0.094	-0.098
	(0.142)	(0.144)	(0.148)	(0.141)	(0.217)	(0.201)
Book Leverage	0.046	0.048	0.048	0.050	0.070	0.068
	(0.042)	(0.041)	(0.044)	(0.044)	(0.067)	(0.070)
Log(Sales)	-0.001	-0.000	-0.001	0.000	0.044***	0.044***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.015)	(0.015)
Outstanding Bank Loan Dummy	0.015	0.016	0.015	0.016	0.000	0.000
	(0.021)	(0.023)	(0.022)	(0.022)	(0.046)	(0.046)
Rating FEs	Yes	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Industry (FF-12) FEs	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,491	2,481	2,491	2,481	1,213	1,209
R-squared	0.102	0.103	0.101	0.102	0.068	0.068

Table 5. Impact of Financial Constraints and Growth Opportunities

This table shows the impact of financial constraints (FC) and growth opportunities on the upsizing-to-demand sensitivity. The dependent variable is *Upsize Dummy*. *Demand Decile* is the negative value of the residual term from estimating equation (1) using *Spread Compression* as the dependent variable without controlling for NEIO, in deciles. In column (1), *HY* is an indicator for HY offerings. In column (2), *High, Mid, and Low FC* (the omitted group) equals one for observations with rating of AAA/AA/A, BBB, and BB and below, and zero otherwise. In columns (3)-(5), *High, Mid, and Low FC* equals one for observations that rank at the top, medium, and bottom tercile in the yearly distribution of leverage ratio, WW index, and HP index, respectively, and zero otherwise. *High, Mid, and Low Q* equals one for observations that rank at the top, medium, and bottom tercile in the yearly distribution of *Tobin's Q*, and zero otherwise. Other controls include *Log(Initial Offering Amount), Log(Maturity), Rule 144A Dummy, First Offering Dummy, Tobin's Q, Return on Assets, Book Leverage, Log(Sales), Minus notch,* and *Outstanding Bank Loan Dummy*. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The sample period is between September 2010 and May 2018.

	Financial Constraint (FC) Measure:					
	HY	Rating	Leverage	WW	HP	
	(1)	(2)	(3)	(4)	(5)	(6)
HY*Demand Decile	0.008					
	(0.005)					
Mid FC*Demand Decile		0.012***	0.005	0.001	0.016***	
		(0.004)	(0.005)	(0.005)	(0.005)	
High FC*Demand Decile		0.015***	0.011**	0.006	0.010*	
		(0.005)	(0.005)	(0.005)	(0.005)	
HY	0.270***					
	(0.038)					
Mid FC		0.012	0.032	0.060*	-0.033	
		(0.027)	(0.032)	(0.031)	(0.032)	
High FC		0.308***	0.032	0.051	-0.030	
		(0.043)	(0.032)	(0.038)	(0.034)	
Mid Q*Demand Decile						-0.003
						(0.005)
High Q*Demand Decile						-0.008*
						(0.005)
Mid Q						0.071**
						(0.032)
High Q						0.118***
						(0.035)
Demand Decile	0.004**	-0.003	0.001	0.002	-0.002	0.011***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.004)
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes
Rating FEs	No	No	No	No	No	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Industry (FF-12) FEs	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,690	3,690	3,690	3,690	3,690	3,690
R-squared	0.178	0.184	0.127	0.132	0.132	0.186

Table 6. Upsizing and Issuer Capital Structure

This table relates upsizing to changes in issuers' capital structure during the nine quarters around the offering event. Odd columns include firm fixed effects, and even columns include issue-cohort fixed effects. Quarter dummies are relative to the offering quarter (quarter 0). *Quarter -4* is the omitted group. *Upsized Amount* is the dollar upsizing amount for a firm's bond offerings during the offering quarter scaled by the firm's total asset in the quarter of issuance. Controls include *quarter dummies, Tobin's Q, Return on Assets, Log(Sales), Outstanding Bank Loan Dummy, Minus Notch, Treasury Rate, Treasury Slope,* and *Credit Spread.* All variables are defined in Appendix B. Robust standard errors clustered at the issuer level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: IG Bonds

	Bank Debt		Cash Holdings		Net Equity Issuance		Payout		Leverage Ratio	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Upsized Amount	0.664**		-0.266		-0.029		0.035		0.035	
	(0.261)		(0.163)		(0.061)		(0.060)		(0.357)	
Quarter -3 * Upsized Amount	-0.011	0.050	0.019	0.016	0.018	0.019	-0.042	-0.044	-0.109	-0.086
	(0.111)	(0.105)	(0.084)	(0.083)	(0.071)	(0.071)	(0.069)	(0.069)	(0.096)	(0.095)
Quarter -2 * Upsized Amount	0.215	0.234	-0.007	0.031	0.040	0.046	-0.061	-0.068	-0.076	-0.097
	(0.191)	(0.189)	(0.106)	(0.098)	(0.068)	(0.068)	(0.067)	(0.067)	(0.145)	(0.143)
Quarter -1 * Upsized Amount	0.111	0.126	-0.013	0.018	0.031	0.038	-0.024	-0.031	0.220	0.190
	(0.196)	(0.193)	(0.138)	(0.137)	(0.084)	(0.084)	(0.081)	(0.081)	(0.200)	(0.201)
Quarter 0 * Upsized Amount	-0.552**	-0.557**	0.482***	0.513***	-0.059	-0.050	0.036	0.025	0.732***	0.700***
	(0.246)	(0.248)	(0.180)	(0.178)	(0.082)	(0.083)	(0.082)	(0.082)	(0.227)	(0.221)
Quarter 1 * Upsized Amount	-0.624***	-0.617***	0.251	0.288*	-0.048	-0.037	-0.012	-0.023	0.702***	0.717***
	(0.239)	(0.237)	(0.176)	(0.169)	(0.077)	(0.077)	(0.075)	(0.075)	(0.248)	(0.242)
Quarter 2 * Upsized Amount	-0.586**	-0.615**	0.284*	0.330**	0.043	0.053	-0.088	-0.097	0.817***	0.777***
	(0.267)	(0.267)	(0.165)	(0.159)	(0.076)	(0.076)	(0.076)	(0.076)	(0.256)	(0.257)
Quarter 3 * Upsized Amount	-0.631**	-0.650**	0.374**	0.422**	-0.014	-0.002	0.011	-0.000	0.598**	0.562**
	(0.260)	(0.263)	(0.177)	(0.172)	(0.071)	(0.071)	(0.071)	(0.071)	(0.252)	(0.252)
Quarter 4 * Upsized Amount	-0.550*	-0.585**	0.319*	0.383**	0.027	0.039	-0.052	-0.064	0.591**	0.576**
	(0.290)	(0.295)	(0.181)	(0.175)	(0.064)	(0.065)	(0.062)	(0.063)	(0.264)	(0.262)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Issuer FEs	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Issue-cohort FEs	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Year-quarter FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17,856	17,856	27,926	27,926	27,926	27,926	27,926	27,926	27,926	27,926
R-squared	0.674	0.806	0.815	0.899	0.377	0.476	0.481	0.572	0.771	0.914

Table 6. Upsizing and Capital Structure - continued

Panel B: HY Bonds

	Bank Debt		Cash Holdings		Net Equity Issuance		Payout		Leverage Ratio	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Upsized Amount	0.503***		-0.027		0.010		0.003		0.114	
	(0.191)		(0.056)		(0.039)		(0.010)		(0.255)	
Quarter -3 * Upsized Amount	-0.005	-0.061	0.034	0.034	0.014	0.015	-0.005	-0.005	0.043	0.038
	(0.122)	(0.090)	(0.054)	(0.054)	(0.042)	(0.042)	(0.015)	(0.015)	(0.086)	(0.089)
Quarter -2 * Upsized Amount	-0.104	-0.064	0.010	0.004	0.002	0.004	0.007	0.007	0.031	0.001
	(0.112)	(0.097)	(0.060)	(0.060)	(0.050)	(0.050)	(0.013)	(0.013)	(0.131)	(0.129)
Quarter -1 * Upsized Amount	-0.032	-0.102	-0.054	-0.057	0.020	0.023	0.005	0.003	0.000	-0.051
	(0.194)	(0.192)	(0.061)	(0.062)	(0.051)	(0.051)	(0.014)	(0.014)	(0.145)	(0.142)
Quarter 0 * Upsized Amount	-0.666***	-0.664***	0.293***	0.289***	-0.078	-0.075	0.003	0.001	0.378*	0.349*
	(0.180)	(0.178)	(0.069)	(0.068)	(0.050)	(0.050)	(0.021)	(0.021)	(0.214)	(0.212)
Quarter 1 * Upsized Amount	-0.528***	-0.587***	0.181***	0.172***	-0.038	-0.035	0.020	0.019	0.506**	0.467**
	(0.180)	(0.166)	(0.061)	(0.060)	(0.047)	(0.047)	(0.015)	(0.015)	(0.198)	(0.196)
Quarter 2 * Upsized Amount	-0.580***	-0.522***	0.125*	0.117*	0.011	0.015	0.020	0.018	0.434**	0.418**
	(0.179)	(0.167)	(0.068)	(0.066)	(0.049)	(0.049)	(0.015)	(0.015)	(0.210)	(0.210)
Quarter 3 * Upsized Amount	-0.389**	-0.415**	0.116*	0.106*	-0.026	-0.019	0.002	-0.001	0.439**	0.391*
	(0.197)	(0.186)	(0.063)	(0.063)	(0.044)	(0.045)	(0.012)	(0.012)	(0.219)	(0.220)
Quarter 4 * Upsized Amount	-0.498***	-0.477***	0.108	0.090	0.004	0.007	0.012	0.009	0.298	0.298
	(0.178)	(0.174)	(0.078)	(0.078)	(0.044)	(0.044)	(0.014)	(0.014)	(0.224)	(0.227)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Issuer FEs	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Issue-cohort FEs	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Year-quarter FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	15,139	15,139	25,343	25,343	25,343	25,343	25,343	25,343	25,343	25,343
R-squared	0.710	0.822	0.681	0.795	0.198	0.258	0.370	0.456	0.745	0.886

Table 7. Upsizing and Issuer Investment

This table provides regressions explaining changes in capital expenditures for the nine quarters around bond offering events. The dependent variable, *Capital Expenditure*, is quarterly capex scaled by assets. Odd columns include firm fixed effects, whereas even columns include issue-cohort fixed effects. *Post issue* is one for the quarters zero (i.e., the offering quarter) to five, and zero otherwise. *Upsized Amount* is the dollar upsizing amount for a firm's bond offerings during the offering quarter scaled by the firm's total asset in the quarter of issuance. *Tobin's Q* is the market value of assets over book value of total assets. Controls include *Return on Assets, Log(Sales), Outstanding Bank Loan Dummy, Minus Notch*. All variables are defined in Appendix B. Robust standard errors clustered at the issuer level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	IG				HY			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post issue	-0.000*	0.000	-0.000	0.000	-0.000	0.001*	0.001	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Upsized Amount	0.045*		0.045*		-0.006		-0.006	
	(0.025)		(0.025)		(0.017)		(0.017)	
Tobin's Q	0.002***	0.002***	0.002***	0.002***	0.006***	0.005***	0.006***	0.005***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Post issue * Upsized Amount	-0.026	-0.026	-0.017	-0.036	0.013	0.007	-0.029	-0.031
	(0.019)	(0.018)	(0.032)	(0.034)	(0.017)	(0.017)	(0.024)	(0.028)
Post issue * Upsized Amount			-0.005	0.006			0.031**	0.028*
* Tobin's Q			(0.016)	(0.017)			(0.012)	(0.014)
Post issue * Tobin's Q			0.000	0.000			-0.001	-0.000
			(0.000)	(0.000)			(0.000)	(0.001)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Issuer FEs	Yes	No	Yes	No	Yes	No	Yes	No
Issue-cohort FEs	No	Yes	No	Yes	No	Yes	No	Yes
Year-quarter FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	27,926	27,926	27,926	27,926	25,343	25,343	25,343	25,343
R-squared	0.751	0.827	0.751	0.827	0.705	0.765	0.705	0.765

Appendix A: Price and Quantity Adjustments in the Primary Market

In this appendix, we use a simplified example to illustrate the price update and upsizing process in the corporate bond primary market. In Panel A of Figure A1, S0 represents the underwriters' expected credit supply (investor demand) curve prior to taking orders for the book. The slope of S0 is consistent with Figure 1 of Albuquerque et al. (2022), who show that credit supply for government bonds quickly decreases as the offering yield decreases. They also show there is an upper limit in investor demand, whereby quantity stops responding to yield not far from the market-clearing point. For corporate bonds, the issuer initially proposes a yield (the initial price talk, i_{IPT}) and offering amount, both of which are observable (Point A0). Underwriters set i_{IPT} at a level such that the offering will be oversubscribed (Feldstein and Fabozzi, 2008); thus, the underwriters' expected yield (based on expected credit supply) falls below i_{IPT} and is unobservable (Point A1 at $i_{expected}$).

Line D is the issuers' demand curve. We assume the demand curve is vertical at least above the expected offering yield and possibly to some extent below, based on these empirical facts: 1) the majority of bond offerings launch at the proposed offering amount, despite that the final offering yield often falls below the IPT; 2) downsizing is rare. When the yield becomes sufficiently low, the demand curve may remain vertical (Panels A and B), consistent with the fact that many bond offerings do not upsize even if the oversubscription ratio is high, or may become downward sloping (Panel C), consistent with the fact that some bond offerings are upsized.

The underwriter sets i_{IPT} and the proposed offering amount to generate an expected level of oversubscription. For simplicity, we assume the oversubscription ratio at the expected offering yield is 1, such that all bonds are successfully sold. Once orders are submitted to the book, the level of oversubscription is realized. We use Panels A, B, and C to illustrate the following three

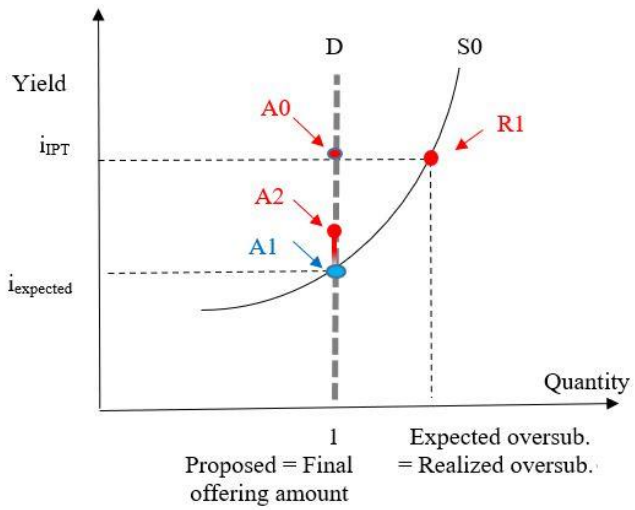
cases: 1) realized oversubscription equals expected oversubscription; 2) realized oversubscription is *greater* than expected oversubscription, but firms do *not* respond to credit supply by increasing the offering amount; and 3) realized oversubscription is *greater* than expected oversubscription, and firms respond to credit supply by increasing the offering amount.

In Panel A of Figure A1, realized oversubscription is equal to expected. The underwriter will lower ("tighten") the yield to Point A2, where the initially proposed quantity is offered at a yield at or above Point A1, depending on the desired level of underpricing for the offering. The final offering yield and amount (Point A2) are observed.

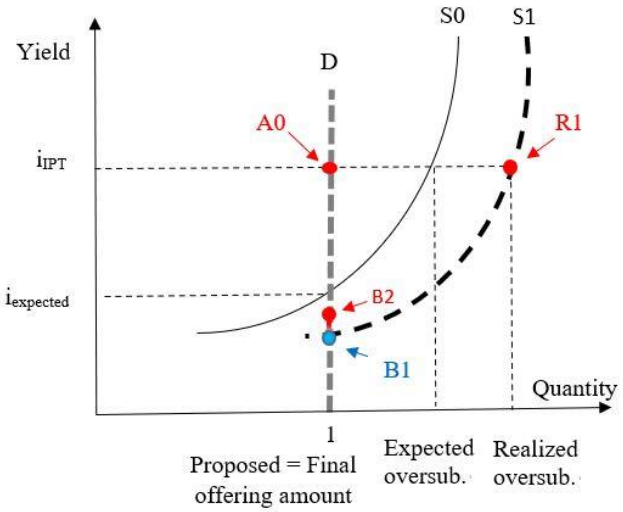
Panel B shows the case where realized oversubscription at i_{IPT} is greater than expected, meaning realized credit supply is greater than expected (supply curve S1), but firms have not planned to respond to credit supply by increasing the offering amount. The observed offering yield will be set at Point B2, below $i_{expected}$ but above point B1 on curve S1, again depending on desired underpricing.

Panel C shows the case where the demand curve becomes downward sloping below $i_{expected}$, but not above, as firms rarely downsize offerings. When the credit supply shifts from S0 to S1, the final offering amount may or may not increase to the intersection of the firm's demand curve and S1, depending on whether firms have an upper limit on their desired offering amount. Depending on the desired offering amount and desired underpricing, the final offering amount and yield will lie somewhere in the shaded sector (Area C2).

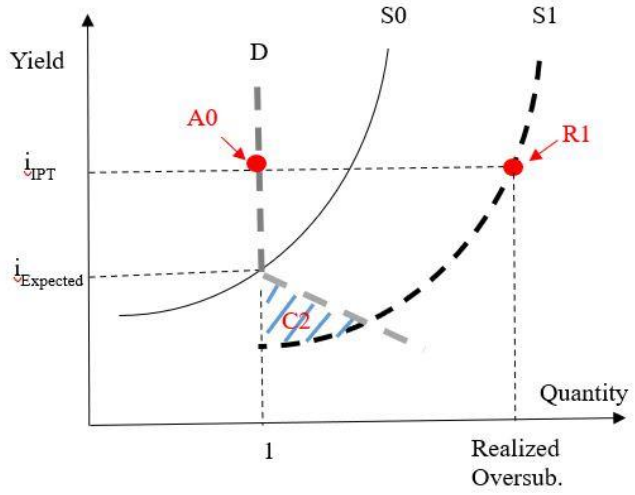
Figure A1. Price Update and Upsizing in the Primary Market



Panel A. Realized investor demand equals expected. Yield is reduced from A0 to A2.



Panel B. Realized investor demand exceeds expected, but firm *does not* respond by increasing quantity. Yield is reduced from A0 to B2.



Panel C. Realized investor demand exceeds expected, and firm responds by *increasing quantity*. Yield is reduced from A0 to within area C2.

Appendix B: Key Variable Definitions

Variables	Definition and Source
Primary Market Variables	
Initial Offering Amount	The offering amount disclosed in pre-offering filings. If an offering has no pre-offering filings or the intended offering amount is missing from the pre-offering filings, we look for the intended offering amount disclosed in post-offering filings. If a firm does not discuss its intended offering amount in any filings, we search for this amount from new issue news reported on Bloomberg. Data source: SEC, Bloomberg
Final Offering Amount	The offering amount recorded in FISD. Data source: FISD
Upsize Dummy	An indicator that equals one if the final offering amount of a bond is greater than the intended offering amount, and zero otherwise. Data source: SEC, Bloomberg
Upsize Magnitude	(Final offering amount - intended offering amount) / intended offering amount. Downsized offerings have negative upsize magnitude. Data source: SEC, Bloomberg
Oversubscription ratio	Order book size / initial offering amount. Data source: Refinitiv
Spread compression	Offering spread (yield) minus initial offering spread (yield), in bps. Data source: Refinitiv
Prior Demand -- Oversubscription ratio (Spread compression)	Calculated as the average oversubscription ratio (spread compression) of all offerings in the month prior to the new offering date, separately for IG and HY offerings.
Bond Characteristics	
Maturity	Maturity in years. Data source: FISD
Rule 144A Dummy	An indicator of whether the bond offering is Rule 144A. Data source: FISD
First Offering Dummy	An indicator variable that equals one if the new offering is the first bond of the issuer in FISD, and zero otherwise. Data source: FISD
Credit Rating	Letter ratings AAA, AA, A, BBB, BB, B, and CCC are assigned to risk categories 1 through 7, respectively. We consider the ratings from S&P, Moody, and Fitch. If their ratings for a bond are inconsistent, we choose the median rating when there are ratings from three agencies, and we choose the lower rating when there are ratings from two rating agencies. Data source: FISD, SDC and Capital IQ
Plus (No) [Minus] Notch	An indicator variable that equals one if the bond's detailed letter rating carries a "+" (no) ["-"] sign, and zero otherwise. Data source: FISD, SDC and Capital IQ

Firm Characteristics

Tobin's Q	Market value of assets (at-seq+prcc_f*csho) over book value of total assets. Data source: Capital IQ, Compustat
Return on Assets	Net income over total assets. Data source: Capital IQ, Compustat
Book Leverage	Total debt (dlc+dltt) over total assets. Data source: Capital IQ, Compustat
Log(Sales)	The natural logarithm of sales. Data source: Capital IQ, Compustat
Outstanding Bank Loan Dummy	An indicator that equals one if the firm has a bank loan contract outstanding at the time of bond issuance, and zero otherwise. Data source: Dealscan
WW Index	Following Farre-Mensa and Ljungqvist (2016), WW index is calculated as –0.091 [(ib +dp)/at] – 0.062[indicator set to one if dvc + dvp is positive, and zero otherwise] + 0.021[dltt/at] – 0.044[log(at)] +0.102[average industry sales growth] – 0.035[sales growth]. Data source: Compustat
HP Index	Following Farre-Mensa and Ljungqvist (2016), HP index is –0.737Size + 0.043Size^2 – 0.040Age, where Size equals the log of inflation-adjusted Compustat item *at* (in 2004 dollars). We calculate Age as the number of years the firm is in Compustat. Furthermore, Size is capped at (the log of) $4.5 billion and Age at 37 years following Hadlock and Pierce (2010). Data source: Compustat

Market Conditions

IG-NEIO/HY-NEIO	Following Ben-Rephael, Choi, and Goldstein (2021), *IG-NEIO/HY-NEIO* is calculated as monthly intra-family mutual fund net exchanges (exchanges-in – exchanges-out) for IG mutual funds/HY corporate bond mutual funds, scales by the total net assets of the category in the previous month. We multiply this value by 100. Data source: ICI
High-Yield Share (HYS)	The percentage of the par value of non-financial high-yield-rated bond issues in the quarter preceding the offering date. Data source: FISD
Excess Bond Premium	A measure of investor sentiment or risk appetite in the corporate bond market introduced by Gilchrist and Zakrajšek (2012). Data source: Federal Reserve
Treasury Rate	1-year Treasury rate. Data source: WRDS
Treasury Slope	10-year Treasury rate minus 1-year Treasury rate. Data source: WRDS
Forecast Dispersion of T-bill	The difference between the 75th percentile minus 25th percentile of the professional forecasts for levels of the 3-month Treasury bill rate. Data source: Philadelphia Federal Reserve

For the DID sample

Bank Debt	Total outstanding bank debt over total assets. Data source: Capital IQ
Cash Holdings	Total cash and short-term investments over total assets. Data source: Capital IQ
Net Equity Issuance	Common and preferred stock issuance minus common and preferred stock repurchase, scaled by total assets. Data source: Capital IQ

Payout Ratio	Common and preferred stock repurchase plus common and preferred stock dividend, scaled by total assets. Data source: Capital IQ
Leverage Ratio	Total debt over total assets. Data source: Capital IQ
Capex	Capital expenditures over total assets. Data source: Capital IQ

Appendix C. Additional Tests

Table C1. Issuers' Choice of Price and Quantity Adjustments

This table shows the results of a multinomial logit model for the subsample of IG bonds issued between September 2010 and May 2018 with available order book size data, where the dependent variable "Choice" is a categorical variable based on an issuer's four possible decisions for an offering: (1) the offering is not upsized, and spread compression is not large (large spread compression indicates spread compression below the median of all offerings issued of the same year rating); (2) the offering is not upsized, but spread compression is large; (3) the offering is upsized, but spread compression is not large; and (4) the offering is upsized and spread compression is large. Choice 1 is the omitted baseline. Rating, year, and industry fixed effects are controlled. All other variables are defined in Appendix B. Robust standard errors clustered at the issuer level are reported in parentheses, and relative risk ratios are reported in brackets. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Choice 2: Not upsized & large spread compression	Choice 3: Upsized & spread compression not large	Choice 4: Upsized & large spread compression
Oversubscription Ratio	0.828***	0.273**	0.902***
	(0.070)	(0.110)	(0.085)
	[2.289]	[1.314]	[2.465]
Log(Initial Offering Amount)	0.520***	-2.546***	-1.172***
	(0.152)	(0.337)	(0.385)
Log(Maturity)	-0.298***	0.137	-0.241*
	(0.082)	(0.138)	(0.129)
Rule 144A Dummy	0.189	-14.336***	0.518
	(0.320)	(0.528)	(0.715)
First Offering Dummy	0.187	0.068	0.217
	(0.298)	(0.719)	(0.578)
Minus Notch	0.359**	-0.473	0.173
	(0.143)	(0.369)	(0.316)
Tobin's Q	0.071	0.065	0.017
	(0.095)	(0.189)	(0.228)
Return on Assets	1.300	0.004	0.217
	(1.624)	(2.859)	(2.998)
Book Leverage	-0.419	-1.535	1.271
	(0.512)	(1.465)	(0.985)
Log(Sales)	-0.201***	-0.124	-0.194
	(0.077)	(0.180)	(0.156)
Outstanding Bank Loan	-0.237	0.126	0.280
Dummy	(0.261)	(0.545)	(0.589)
Observations	2,491		
Pseudo R-squared	0.229		
# of Bonds in Each Outcome	1,253	84	139

Table C2. Investor Demand and Credit Market Conditions – W/O Controlling for NEIO

This table provides OLS regressions explaining *Oversubscription Ratio* and *Spread Compression*, for the subsample of IG bonds issued between September 2010 and May 2018 with initial spread information and/or book size information. The specifications of this table are almost identical to those of Table 3 of the main paper, except that NEIO is not included as an explanatory variable. The dependent variable in columns (1) and (2) is *Oversubscription Ratio* and in columns (1)-(4) is *Spread Compression*. All variables are defined in Appendix B. Robust standard errors clustered at the issuer level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	IG				HY	
	Oversubscription Ratio		Spread Compression		Spread Compression	
	(1)	(2)	(3)	(4)	(5)	(6)
HYS	-1.462	-1.438	11.115**	8.805	5.362	3.266
	(1.044)	(1.032)	(5.550)	(5.596)	(10.701)	(10.733)
Excess Bond Premium	0.559**	0.585**	-4.552**	-4.827***	7.339	7.117
	(0.284)	(0.281)	(1.775)	(1.786)	(5.452)	(5.625)
Treasury Rate	-0.474***	-0.341*	0.260	-0.329	-1.994	-1.760
	(0.180)	(0.182)	(0.961)	(0.977)	(2.748)	(2.749)
Treasury Slope	-0.354***	-0.286**	4.097***	2.274***	2.309	2.198
	(0.132)	(0.134)	(0.738)	(0.834)	(1.438)	(1.450)
Forecast Dispersion of T-bill	-4.556***	-3.810***	1.138	3.546	-19.800	-16.545
	(1.369)	(1.381)	(7.266)	(7.299)	(21.166)	(22.164)
Prior Demand -- Oversubscription Ratio		0.203***				
		(0.078)				
Prior Demand -- Spread Compression				0.396***		0.113
				(0.074)		(0.126)
Minus Notch	0.240*	0.243*	-1.475**	-1.432*	-1.851	-1.705
	(0.135)	(0.136)	(0.746)	(0.743)	(1.395)	(1.404)
Log(Initial Offering Amount)	-1.138***	-1.149***	0.297	0.510	2.575	2.684
	(0.114)	(0.112)	(0.602)	(0.601)	(1.831)	(1.862)
Log(Maturity)	0.112**	0.107**	0.440	0.482*	-2.779	-2.902
	(0.052)	(0.052)	(0.276)	(0.269)	(2.769)	(2.792)
Rule 144A Dummy	-0.261	-0.265	0.255	0.137	0.082	0.120
	(0.309)	(0.310)	(1.860)	(1.883)	(1.271)	(1.272)
First Offering Dummy	0.546*	0.595**	-0.334	-1.113	6.397***	6.207***
	(0.302)	(0.302)	(1.616)	(1.612)	(2.377)	(2.396)
Tobin's Q	0.009	0.020	-0.119	-0.031	-2.133*	-2.219*
	(0.078)	(0.078)	(0.459)	(0.426)	(1.281)	(1.284)
Return on Assets	1.214	1.117	-5.064	-8.225	-14.604	-14.204
	(1.672)	(1.649)	(9.839)	(9.699)	(12.089)	(12.125)
Book Leverage	-1.532***	-1.498***	4.059*	4.725**	2.321	2.280
	(0.467)	(0.459)	(2.227)	(2.179)	(3.915)	(3.946)
Log(Sales)	-0.130*	-0.133*	1.181***	1.214***	-0.311	-0.303
	(0.076)	(0.077)	(0.435)	(0.434)	(0.748)	(0.757)
Outstanding Bank Loan Dummy	-0.149	-0.143	0.900	0.653	-3.801	-3.737
	(0.245)	(0.244)	(1.106)	(1.114)	(2.868)	(2.882)
Constant	14.752***	13.703***	-41.969***	-33.581***	-10.320	-9.407
	(0.943)	(0.984)	(4.955)	(5.184)	(12.505)	(12.560)
Rating FEs	Yes	Yes	Yes	Yes	Yes	Yes
Industry (FF-12) FEs	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,491	2,481	2,491	2,481	1,213	1,209
R-squared	0.250	0.255	0.177	0.198	0.080	0.081

Table C3. Upsizing Magnitude and Unexpected Credit Supply

This table shows the relationship between the magnitude of upsizing and unexpected credit supply. The specifications of this table are almost identical to those of Table 4 of the main paper, except that the dependent variable is *Upsize Magnitude*. *Resi Demand -- Oversubscription (Spread Compr.)* is the residual term (the negative value of the residual term) from estimating equation (1) without controlling NEIO, where the dependent variable is *Oversubscription Ratio (Spread Compression).* All other variables are defined in Appendix B. Robust standard errors obtained from bootstrapping the two-stage regressions 1,000 times are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	IG				HY	
	(1)	(2)	(3)	(4)	(5)	(6)
Resi Demand -- Oversubscription	0.005***	0.005***				
	(0.001)	(0.001)				
Resi Demand – Spread Compr.			0.001***	0.001***	0.001***	0.001**
			(0.000)	(0.000)	(0.000)	(0.000)
Minus Notch	-0.001	-0.001	-0.001	-0.001	0.011	0.013
	(0.005)	(0.005)	(0.004)	(0.005)	(0.013)	(0.013)
Log(Initial Offering Amount)	-0.035***	-0.035***	-0.035***	-0.035***	-0.037***	-0.037***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.013)	(0.013)
Log(Maturity)	0.001	0.002	0.001	0.002	0.018	0.019
	(0.002)	(0.002)	(0.002)	(0.002)	(0.025)	(0.025)
Rule 144A Dummy	-0.012	-0.013*	-0.012	-0.013	-0.023	-0.020
	(0.008)	(0.008)	(0.008)	(0.008)	(0.015)	(0.015)
First Offering Dummy	-0.003	-0.003	-0.003	-0.003	-0.009	-0.010
	(0.008)	(0.008)	(0.008)	(0.008)	(0.014)	(0.014)
Tobin's Q	0.000	0.000	0.001	0.001	0.034***	0.035***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.010)	(0.010)
Return on Assets	-0.019	-0.020	-0.025	-0.024	-0.075	-0.081
	(0.055)	(0.054)	(0.056)	(0.055)	(0.090)	(0.087)
Book Leverage	0.017	0.018	0.018	0.019	0.053	0.054*
	(0.013)	(0.013)	(0.013)	(0.014)	(0.032)	(0.030)
Log(Sales)	-0.000	0.000	-0.000	0.000	0.041***	0.042***
	(0.003)	(0.003)	(0.002)	(0.002)	(0.007)	(0.007)
Outstanding Bank Loan Dummy	0.009	0.009	0.009	0.009	-0.015	-0.017
	(0.008)	(0.008)	(0.008)	(0.008)	(0.018)	(0.018)
Constant	0.241***	0.239***	0.237***	0.236***	-0.068	-0.073
	(0.029)	(0.029)	(0.030)	(0.028)	(0.086)	(0.084)
Rating FEs	Yes	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Industry (FF-12) FEs	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,491	2,481	2,491	2,481	1,213	1,209
R-squared	0.092	0.093	0.091	0.092	0.127	0.125

Table C4. Upsizing and *Expected* Credit Supply

This table shows the relationship between upsizing and expected credit supply. The dependent variable in this table is *Upsize Dummy*. The specifications of this table are almost identical to those of Table 4 of the main paper, except that the key explanatory variables are *predicated* values of investor demand, as opposed to the residual terms. All other variables are defined in Appendix B. Robust standard errors obtained from bootstrapping the two-stage regressions 1,000 times are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	IG				HY	
	(1)	(2)	(3)	(4)	(5)	(6)
Predicted Demand --	0.027	-0.000				
Oversubscription Ratio	(0.030)	(0.025)				
Predicted Demand --			-0.001	0.000	-0.010	-0.006
Spread Compression			(0.003)	(0.003)	(0.012)	(0.009)
Minus Notch	-0.026	-0.019	-0.019	-0.020	0.019	0.013
	(0.016)	(0.016)	(0.015)	(0.015)	(0.044)	(0.040)
Log(Initial Offering Amount)	-0.097***	-0.129***	-0.128***	-0.128***	-0.048	-0.036
	(0.036)	(0.032)	(0.012)	(0.012)	(0.048)	(0.044)
Log(Maturity)	0.005	0.008	0.007	0.008	-0.040	-0.052
	(0.008)	(0.007)	(0.007)	(0.007)	(0.076)	(0.071)
Rule 144A Dummy	-0.012	-0.021	-0.020	-0.020	-0.046	-0.044
	(0.032)	(0.030)	(0.029)	(0.028)	(0.039)	(0.037)
First Offering Dummy	-0.001	0.013	0.012	0.013	-0.082	-0.056
	(0.032)	(0.033)	(0.028)	(0.028)	(0.087)	(0.068)
Tobin's Q	0.003	0.004	0.004	0.004	0.079**	0.071**
	(0.008)	(0.008)	(0.007)	(0.008)	(0.037)	(0.031)
Return on Assets	-0.144	-0.113	-0.106	-0.115	0.066	-0.002
	(0.148)	(0.152)	(0.143)	(0.152)	(0.314)	(0.285)
Book Leverage	0.087	0.047	0.042	0.048	0.048	0.055
	(0.064)	(0.058)	(0.043)	(0.045)	(0.098)	(0.080)
Log(Sales)	0.002	-0.000	-0.002	0.000	0.047**	0.046***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.018)	(0.017)
Outstanding Bank Loan Dummy	0.020	0.016	0.015	0.016	0.039	0.022
	(0.024)	(0.022)	(0.021)	(0.022)	(0.077)	(0.064)
Constant	0.545	0.888***	0.919***	0.877***	0.320	0.282
	(0.386)	(0.326)	(0.117)	(0.113)	(0.271)	(0.252)
Rating FEs	Yes	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Industry (FF-12) FEs	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,491	2,481	2,491	2,481	1,213	1,209
R-squared	0.097	0.097	0.096	0.097	0.062	0.061

Table C5. Firm and Market Characteristics Before and After Overlap Weights

This table presents the differences in firm characteristics and market conditions before the offering event of upsizing versus non-upsizing issuers, before and after applying the overlap weighting method. All variables are defined in Appendix B. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. IG

	Unweighted Sample			Weighted Sample		
	Mean		Difference	Mean		Difference
	Upsized	Non-upsized		Upsized	Non-upsized	
Return on Assets	0.016	0.018	-0.001*	0.017	0.017	0.000
Tobin's Q	1.632	1.730	-0.099**	1.646	1.628	0.016
Log(Sales)	7.690	7.860	-0.170***	7.717	7.713	0.004
Book Leverage	0.295	0.305	-0.010	0.295	0.296	-0.001
Outstanding Bank Loan Dummy	0.948	0.914	0.034***	0.946	0.940	0.006
Minus Notch	0.373	0.372	0.002	0.372	0.379	-0.007
Treasury Rate	2.095	2.365	-0.270**	2.122	2.181	-0.059
Treasury Slope	1.553	1.504	0.049	1.547	1.543	0.004
IG-NEIO （%）	0.011	-0.001	0.012***	0.009	0.006	0.003
Forecast Dispersion of T-bill	0.187	0.189	-0.002	0.187	0.190	-0.002

Panel B. HY

	Unweighted Sample			Weighted Sample		
	Mean		Difference	Mean		Difference
	Upsized	Non-upsized		Upsized	Non-upsized	
Return on Assets	0.002	0.004	-0.002	0.003	0.003	0.000
Tobin's Q	1.244	1.217	0.027	1.237	1.232	0.005
Log(Sales)	6.074	5.850	0.224***	6.004	5.981	0.023
Book Leverage	0.470	0.466	0.003	0.467	0.471	-0.004
Outstanding Bank Loan Dummy	0.903	0.854	0.049***	0.891	0.884	0.007
Minus Notch	0.427	0.421	0.006	0.429	0.421	0.008
Treasury Rate	1.658	2.183	-0.525***	1.810	1.868	-0.058
Treasury Slope	1.784	1.636	0.148***	1.744	1.725	0.019
HY-NEIO （%）	0.020	-0.003	0.023	0.001	0.001	0.000
Forecast Dispersion of T-bill	0.159	0.176	-0.017***	0.164	0.165	-0.001