Credit Risk and the Life Cycle of Callable Bonds: Implications for Real Corporate Decisions *

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Abstract

We show that callable bonds have *both* higher yields and lower market prices than non-callable bonds of the same issuer, reflecting the value of call features to issuers and investors. This "cost of callability" and both the inclusion and the exercise of call rights are determined by levels and changes in issuer-specific credit quality. Our agency-based theoretical and empirical analyses further demonstrate that callability reduces debt overhang in corporate mergers and investment. Our results help explain the value and prevalence of callable bonds. They suggest that debt callability is a key capital structure parameter.

JEL classification: G32, G33, G21
Keywords:
Callable bonds, Credit risk, Debt overhang, Corporate mergers, Investment decisions.

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1 Introduction

U.S. companies have increasingly relied on callable bonds as they lever up. From 2000 to 2020, callable bonds grew from 35% to 89% of new bond issues (see top panel of Fig. 1). Differences between callable and non-callable bonds are significant. Within-issuer comparisons show that the average yield is higher for callable bonds. Concurrently, secondary market prices of callable bonds are lower than prices of non-callable bonds. This *high yield–low price* combination is consistent with the notion that the market compensates bond investors for the option value embedded in callable instruments. In theory, call provisions should be particularly valuable in times of high volatility. Indeed, the issuance of callable bonds spiked during the 2000–1 recession, the 2008–9 Financial Crisis, and the Covid-19 Crisis (bottom panel of Fig. 1).

There is limited research on why bond callability is so common and so valuable. To date, the conventional description of calls in textbooks and industry accounts stresses that callability bundles an interest rate option with a bond. When the Treasury yield curve shifts down, firms should call in their debt and reissue at lower yields. We refer to this view, which emphasizes risk-free interest rates as the driver of call decisions and the management of funding costs as the reason for including calls in bonds, as the "interest-rate view." An alternative view stresses that firms have an incentive to call their debt when their own credit risk declines or when credit spreads tighten. We refer to this as the "credit view" of bond calls. This view connects debt call features to agency costs. It is rooted in arguments first found in Bodie and Taggart (1978) and developed in Diamond and He (2014), who show that callability reduces problems associated with debt overhang and that firm decisions are shaped by their ability to call debt early.

We provide a comprehensive new assessment of callable bonds. We do so by first identifying testable hypotheses along the life cycle of callable bonds that discriminate between existing views on callability. We test those hypotheses using information covering decades of life his-

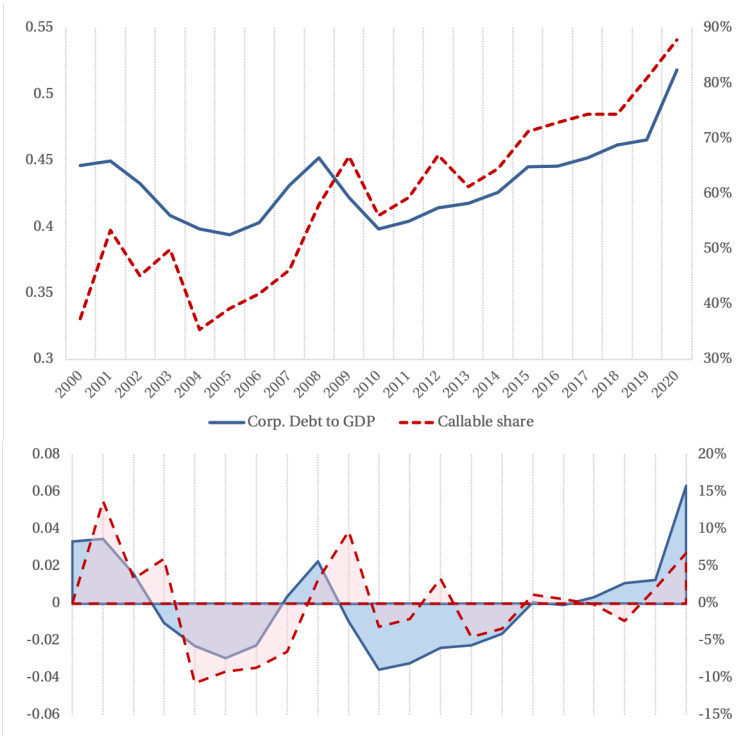

Figure 1. Callable share and leverage. This figure shows corporate debt (normalized by GDP) from U.S. Flow of Funds and the callable share of new bond issues from Mergent FISD. Top panel: levels (leverage on left-hand scale); bottom panel: detrended leverage and callable share. Time series correlations equal 0.6 (p=0.001).

tories of U.S. corporate bonds together with data on secondary market bond prices. We further innovate by pushing forward the underpinnings of agency-based explanations for bond calls. We do so characterizing a well-defined, critical setting where debt callability interacts with agency costs and real activity: corporate mergers. As we discuss below, our argument builds on the insight that target debt creates overhang for acquirers discouraging value-enhancing mergers, and call provisions in targets' debt can reduce agency problems. We develop the implications of our argument for merger announcement returns and merger activity through a simple theoretical framework. We subsequently use a number of empirical strategies to test our model's predictions.[1]

[1] Secondary motives for calls include altering covenants (King and Mauer 2000 and Green 2018) and enabling arbitrage across convertible bonds (Grundy and Verwijmeren 2018). These motives lie outside the scope of our study.

The credit view finds strong support in the data of "fixed-price" bond calls.[2] First, issuers' call decisions are highly predictable by *non-interest* factors. Calls are predicted by positive changes to firm credit quality (e.g., rating upgrades or falling yields on bonds), raising the annual call hazard rate by one third, holding time-series variables (interest rates and spreads) fixed. Observed call decisions reflect identifiable issuer-specific dynamics beyond risk-free rates.

Second, post-issuance prices of callable and non-callable bonds differ as predicted by the credit view. Under this view, calls should be triggered by value improvements (e.g., due to reduced issuer credit risk). Accordingly, the distribution of secondary market prices would have a "missing mass" just above the call threshold *vis-à-vis* matched bonds that cannot be called. This prediction is born out in the data. Concretely, a common call price is 3% above par (see Powers 2021) and this is therefore a predicted price ceiling for many callable bonds. In our sample, 1-in-3 non-callable bonds trade above 1.03 times par, while only 1-in-20 callable bonds do so. On the flip side, the distribution of below-par prices is similar for non-callable and callable bonds. The missing mass of callable bonds with high market prices reflects the theoretical *capped-upside* for investors holding those bonds: in scenarios when a firm does well, callable bond investors do not share in the upside the way investors in non-callable bonds do.

Third, callable bonds should provide higher yields to bondholders as compensation for their limited (capped) future capital gains. We estimate empirically that yields at issue for callable bonds are indeed 27 bps higher than non-callable bonds from the *same issuer*. Our within issuer-month estimations feature controls for duration and maturity, among several other contract parameters, addressing concerns related to selection into issuance of callable debt. We also find that this "cost of callability" varies with credit quality: high-yield (HY) callable bonds have around 40 bps higher yield (this corresponds to a 4% value difference for a ten-year bond).

[2] These are standard bonds for which the call price is set at some predetermined level (see also Tewari et al. 2015). Bonds can also have a "make-whole" call feature which allows the issuer to call at a price that depends on interest rates (effectively a price closer to market value than par). Make-whole calls are rarely exercised.

Our study then connects callable bonds to real firm decisions. Callability limits the upside value of debt claims, leaving more for shareholders when the market's view of firm credit quality improves. Under a contingent-claims framework, callable debt should reduce debt overhang: calls should increase corporate propensity to take on positive-NPV projects. Testing this idea is challenging, however. First, foregoing profitable projects leaves few traces. Second, corporate debt structure is endogenous. We develop a new theory and test design to tackle these challenges using the takeover market as a laboratory. Besides its novelty and importance, one advantage of the acquisition setting is its plausibly cleaner identification.

Our analysis starts from the prior that while a target's debt structure is relevant for takeovers, it is less subject to common self-selection concerns than the bidder's own debt structure. In our model, wealth transfers from acquirer shareholders to target bondholders discourage bids (just like wealth transfers discourage greenfield investment in leveraged firms). The model predicts that callable bond issuers should be targeted in takeovers and that their bondholders should gain less from merger deals. In turn, we show that these predictions are borne out in data of bond prices and M&A activity. For example, while non-callable bondholders witness significant positive returns upon takeover announcements (5-day CARs of 4.3%), matched callable bonds do not. Moreover, callable debt features strongly predict whether a firm becomes a takeover target.

To sharpen our test identification, we use the *ex-ante* contractually-set period when calls *cannot be exercised* — referred to as the "call protection period" — as a quasi-random assignment. This period is ordinarily set to half of bond maturity at the time of issuance (see Xu 2017), which means that the precise time when it ends is pre-determined several years in advance and mechanically related to bond maturity. Our tests compare the likelihood of becoming a takeover target for firms whose callable bonds are in the end of the protection period — not yet callable — to matched bonds that have just become callable. We find that when 20% of the bonds issued by

a company become callable, the hazard rate of becoming an acquisition target increases by 44% on average. To shore up our inferences, we perform a series of placebo tests using firms whose bonds are "make-whole" callable and show that those callable bonds do not impact merger probabilities.[3] Going a step further in identifying the effects of interest, we examine merger activity around government-led deregulatory initiatives (events that trigger large, often unexpected changes in industry consolidation dynamics). In this setting, we find that firms with more callable debt are far more likely to be targeted in the merger waves that follow deregulation.

To make broader inferences about call features and real firm decisions, we also look at bond issuers' fixed capital expenditures. We study how firm investment responds to investment opportunity shocks across firms with *similar leverage ratios* but *different proportions of callable debt*. In this setting, we take industry-input price changes as a measure of shocks to investment opportunities (see also Campello 2003 and Dasgupta et al. 2018). We do so again exploiting the *ex-ante* bond call protection period to address estimation biases. We find that callable debt predicts larger investment responses (by about one fifth of average investment rates) to favorable shocks to input prices. Consistent with agency-based considerations, callable debt significantly raises the elasticity of investment to investment opportunities.

The narrow interest-rate view is still commonly used as a reference framework under which to understand bond callability.[4] Our work shows the weakness of this narrative, and more importantly, demonstrates how the credit view better explains the pricing of bonds *both* at issue and in secondary markets. Our analysis shows how the credit view connects callable bonds to investment incentives and debt overhang. It suggests that this connection is important in

[3]Make-whole bond investors have more upside potential due to the higher strike prices associated with their call options. With more upside potential in the bond value, debt overhang is more important for make-whole bonds, discouraging mergers altogether.

[4]The SEC website (see link) states: "[A]n issuer may choose to call a bond when current interest rates drop below the interest rate on the bond. That way, the issuer can save money by paying off the bond and issuing another bond at a lower interest rate." Much academic work is supportive of this view (see, e.g., Banko and Zhou 2010).

practice and may operate across various types of capital budgeting decisions. Debt callability is a key capital structure parameter — comparable to debt maturity and seniority — bearing important implications for observed corporate behavior. Our analysis of how firms manage the callability of their debt carries further implications for macro-level dynamics (aggregate debt overhang in the corporate sector) and the pricing of credit in the private sector.

The rest of the paper is organized as follows. Section 2 describes our data. Section 3 shows evidence on the limits to the upside value of callable debt. Section 4 theoretically studies the interplay between callable debt and debt overhang, showing how callability shapes merger deals. Section 5 presents empirical results on the real effects of callable bonds. Section 6 concludes.

2 Data and Sampling

We put together multiple, extensive databases. First, we obtain bond data from the Mergent Fixed Income Securities Database (Mergent FISD). We start from the issue- and issuer-specific data on 418,556 U.S. bonds issued between January 1970 and December 2017. In tests of bond features, we use bonds issued between 1985 and 2017, but we include callable bonds issued before 1985 for tests of call decisions. We merge bond issues with the FISD redemption table to obtain detailed information on call provisions at issuance and actions taken after issuance. We calculate the duration for each bond and measure a bond's age and remaining life assuming they will not be called. We collect data on whether a bond is convertible and has covenants. We also use the yield to maturity indicated in Mergent, which is calculated assuming no call.

Our empirical tests use bonds that are callable at a fixed, predetermined price. Bonds can also be callable with a "make-whole" provision, which requires issuers to compensate bondholders for the maximum of the face value or the present value of lost coupons and principal discounted at market interest rates when calling. Bonds can have either a fixed-price or a make-

whole provision, or none, or both. Bonds that have both make-whole and fixed-price call provisions are invariably *first* make-whole callable and *later* fixed-price callable. We classify such bonds as callable if the period during which the fixed-price call provision is active exceeds one year. Since make-whole calls involve paying above par, these calls do not limit wealth transfers to bondholders.[5] As such, we treat make-whole bonds separately in our tests of bond features and use them as a placebo group in tests of the effects of callability. We remove convertible bonds (which might affect debt overhang in different ways) and callable bonds with very low call prices (typically issued in conjunction with warrants).[6] We use Mergent FISD tables to identify which bonds are alive — i.e., not matured, restructured, called, converted, or otherwise ended — at any given point. We also identify bonds that have call features but which have not yet reached the first call date ("Not yet callable"). Summary statistics for our bond sample are in Table 1.

[TABLE 1 ABOUT HERE]

We obtain secondary market bond prices and yields from TRACE and bond credit ratings from Mergent FISD. We collect treasury yields and credit spreads from the FRED database. We identify call decisions based on action variables in Mergent FISD, as well as the redemption file.

We match the bond data to issuer data from Compustat. We compute Tobin's q as the book value of assets minus the book value of equity plus the market value equity, divided by the book value of assets. Age is the log of years since IPO. Leverage is the book value of debt over assets. We measure investment as capital expenditures plus R&D and advertisement expenses, divided by the value of assets. Ratios are winsorized at 1% to alleviate the impact of extreme outliers.

Our M&A sample consists of all completed merger and acquisition deals in Thomson Financial's SDC Database with effective dates between January 1, 1980, and December 31, 2017. We

[5] Xu (2017) and Elsaify and Roussanov (2018) suggest that managing maturity structure may explain why issuers pay a premium to exercise make-whole calls, repurchase through open market transactions, or use tender offers. Julio (2013) and Mao and Tserlukevich (2015) show that these actions are unlikely to impact debt overhang.

[6] Convertible bonds account for 7% of corporate bonds. Only 4% of callable bonds feature very low call prices.

retain deals involving public targets (acquirers can be public or private firms). We exclude deals with missing deal size and restrict our sample to deals where the acquirer did not own shares in the target firm prior to the bid and acquired 100% of the target firm through the bid. These filters yield 9,006 deals where information on target firms is available in Compustat. We define the variable "Target" to be one for any firm which is the object of a successful takeover the following year, zero otherwise. Summary statistics for the firm-year panel are presented in Table 2.

[TABLE 2 ABOUT HERE]

In our analysis of announcement returns for bondholders, we combine the price information from TRACE, M&A data from Thomson SDC, and bond data from Mergent FISD. We require the bonds to have at least two days of trading information during the event window, from one trading day before the announcement to five trading days after the announcement. We also require the bond to have at least two days with trading information over the four weeks leading up to the announcement. These filters result in a sample of 807 bonds issued by 364 target firms.

To identify investment opportunity shocks, we use annual price changes of intermediate inputs for each industry. A decrease in input prices is a positive shock to investment opportunities. We obtain the price indices for inputs at the industry level at the annual frequency from the Bureau of Economic Analysis for our sample period from 1980 to 2015. The price index is then matched to firms by industry (4-digit NAICS).[7]

3 The life cycle of callable bonds

In this section, we provide new, comprehensive evidence of the prevalence of callable bonds, their pricing, and the call behavior of issuers. We discuss how the data patterns we uncover can discriminate between alternative views on bond callability.

[7] As Dasgupta et al. (2018), we use the Chain-Type Price Index for intermediate inputs to measure input prices.

3.1 The prevalence of callable bonds and pricing at issue

Several facts in Table 1 point toward a broad view of call features beyond risk-free interest rates. First, many floating-rate bonds are issued with call rights (see Panel A). The yield on these bonds automatically falls with reference rates. Issuers of callable floating rate bonds are, therefore, not motivated by a view on risk-free interest rates or the desire to hedge them. Instead, the existence of callable floating rate bonds points to a different function, including options on credit spreads and credit risk. Second, High-yield (HY) bonds more commonly include call features. Indeed, 76% of HY bonds are issued with call rights, compared to only 14% of Investment-Grade (IG) bonds. This implies that credit risk motivates calls. Interest rate risk is comparable for IG and HY bonds of the same duration, but HY issuers have higher credit risk. These bonds are thus more likely to change in value due to credit quality improving or credit spreads tightening.

We can think of the "price" of including a call feature as the yield difference between a bond issued with a call provision and a counterfactual bond with identical features except for call provisions. This is unobservable, but we can obtain an estimate of the price of call features using regressions. In our sample, the average yield difference between callable and non-callable bonds is 2.52% (the average yield for callable bonds is 8.40%, and for non-callable bonds 5.88%). This difference may reflect the value of embedded call options, but also differences in duration, credit risk, and so on. To get closer to the price of call features, we compare bonds with different call features but issued by *the same firm in the same month*. In practice, we regress the yield of bond issues on a call indicator and controls, including fixed effects for each combination of issuer and time (month-year). Both differences in credit risk and possible selection bias (due to the choice of issuing callable bonds) will be reduced under this specification. Table 3 reports the results.

[TABLE 3 ABOUT HERE]

In the first column of Table 3, the average yield difference for the fixed-price call feature is 27

bps. As a benchmark, make-whole call features are associated with 16 bps higher yields (borderline significantly different from zero). The point estimate of 27 bps is not a definite price for call features: different issuers likely face different effective prices and macro-economic factors such as interest rate volatility may create time-variation (Jarrow et al. 2010).[8] However, that estimate does establish that calls are quantitatively important to bond yields. As a comparison, the 27 bps difference corresponds to the yield difference associated with a two-notch difference in credit ratings (e.g., A+ *vs.* A–) in our sample. In columns 2 and 3, we separate investment-grade and high-yield bonds. The estimated yield associated with a call feature on average is 16 bps for investment-grade bonds and 39 bps for high-yield bonds (different from each other at the 5% level). These yield patterns make it clear that credit risk is connected to call features in bonds.

3.2 The decision to call and secondary market pricing

The credit view posits that any reason a bond price exceeds the call price should trigger calls (this could be falling rates, falling spreads, and improving issuer credit quality). In Fig. 2, we plot the annual hazard rate of bond calls against a bond's secondary market price at the end of the prior year. The figure displays a non-parametric fit of the call probability, showing a strong relationship between bond prices and calls. For bonds traded below par, around 5% are called. For bonds traded above par, the call incidence rises to as high as 40% (bonds priced 10% above par).

We use regression analysis to separate the impact of changes in interest rates, issuer credit risk, and credit spreads on call decisions. We study the drivers of calls using a linear probability model of call hazard rates controlling for bond features such as remaining maturity as well as year fixed effects, meant to absorb aggregate financial variation (e.g., interest rates, credit spreads) and macro-economic conditions. The results are reported in Table 4.

[8] In unreported results, we show that seniority does not differ between the two types of bonds. The yield differences we find remain if we control for seniority, defined by the security level in Mergent FISD.

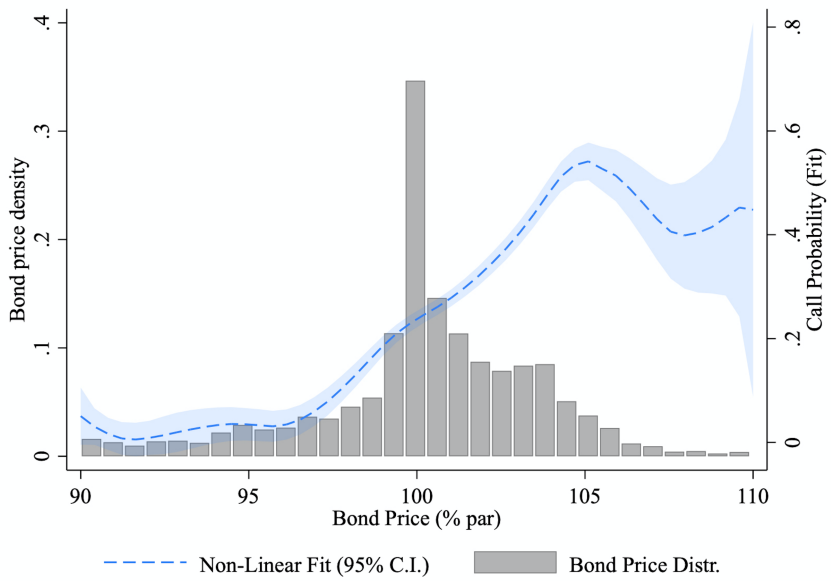

Figure 2. Bond prices and the likelihood of a call. This plot presents the estimated relation between the bond price at the previous year-end (last trade before year-end) and the likelihood of a call in the following year. A locally smoothed, third-degree polynomial fit is estimated. The data contains 5,552 annual observations for 2,931 callable bonds. Confidence intervals assume independence across observations. A histogram of end of year secondary market bond prices is plotted for reference.

[TABLE 4 ABOUT HERE]

The variables of interest capture firm credit quality: lagged changes in issuer credit ratings, market leverage changes, and bond price changes (these are all lagged so that calls in year t are predicted by changes in year $t-1$). Each measure of firm credit quality significantly predicts future call decisions, individually (columns 1 through 3) or together (column 4), beyond interest rates, credit spreads, and macro-economic conditions. The estimated economic magnitudes are significant: a one-notch rating upgrade (i.e., from A to A+) raises the call hazard rate by 1.3% (14% of the sample mean); falling leverage raises the hazard rate by 3.1% (37% of the mean), and a 10-bps drop in the bond yield raises the call hazard by 3.0% (14% of the mean hazard for bonds with market prices). The last column includes issuer controls: market-to-book, enterprise value, and lagged equity return. These variables do not change the estimate for the credit variable.

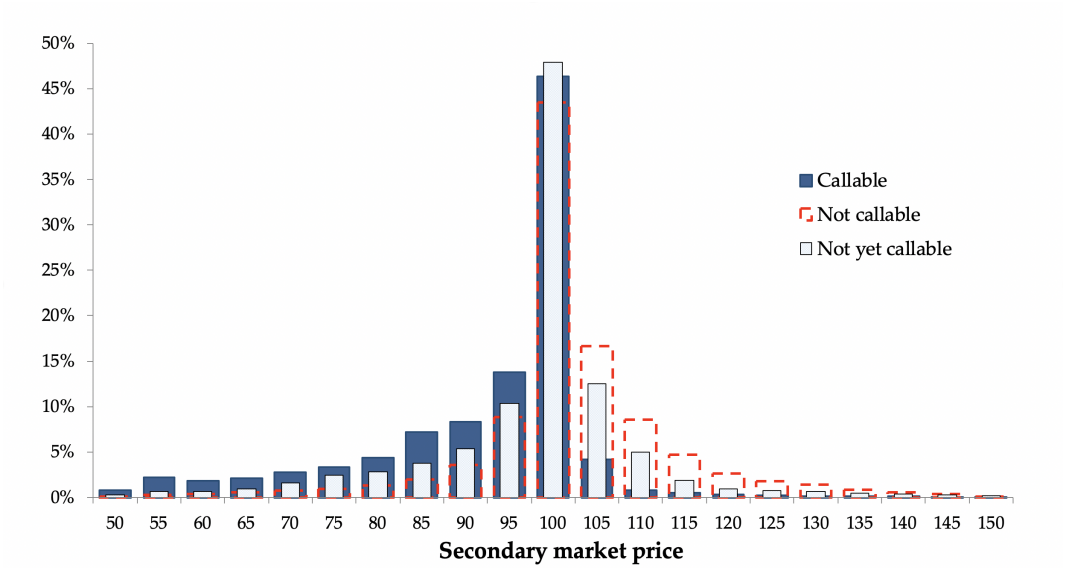

Figure 3. Secondary market prices of callable and non-callable bonds, 2007–2016. This figure presents the histogram of quarter-end prices of corporate bonds, 2007–16, constructed from the TRACE database. Bonds below $100 million of face value, with less than $1 million of transactions for the quarter, and with make-whole call provisions are dropped. The column headings indicate interval midpoints in percent of par. In other words, "100" contains all bonds trading in the interval [0.975,1.025] of par value. "Not callable" refers to bonds without a call provision. "Not yet callable" refers to any bond with a fixed-price call provision that has not reached its first call date and "Callable" to a bond that has reached its first call date.

Given that prices are a strong trigger of calls, we would expect the distribution of prices for callable bonds outstanding at any point in time to be thin at high levels. Fig. 3 illustrates this point by comparing secondary market prices of: (1) non-callable bonds (which have no price "ceiling"); (2) not yet callable bonds (which have not reached the first fixed-price call date, hence only face a ceiling in the future, not currently); and (3) callable bonds (which face a price ceiling). As predicted, callable bonds are less often traded above par compared *both* to non-callable bonds and not yet callable bonds.[9] For example, only 2% of callable bonds trade above 1.075 times par, whereas 11% of not yet callable bonds do so, as well as 21% of non-callable bonds. Similarly, 1.2% of callable bonds trade 1.175 or more times par, compared

[9]Kolmogorov-Smirnov tests show that differences across price distributions are statistically highly significant.

to 3.7% of not yet callable, and 7.7% of non-callable bonds. These data patterns show that call provisions limit the potential upside for bondholders.[10]

Price and call data jointly reveal substantial differences between callable and non-callable bonds in purely financial terms: callable bonds are issued with higher yields but get called when the price rises hence do not provide the same upside potential as non-callable bonds. These differences are quantitatively too large to reflect base interest rates, showing that the credit view matches observed data patterns. We study the real-side implications of this finding in turn.

4 Modeling the real effects of bond callability

In this section, we develop hypotheses that callable bonds improve investment incentives by reducing *ex-post* debt overhang, a key insight from the credit view of callable bonds. We do so by extending the standard contingent-claims framework to study debt overhang in takeovers. This is a particularly interesting setting in which to study the effect of callability on real corporate decisions for a number of reasons. Chiefly, takeovers are "credit positive" for target debtholders since, after the merger, the target firm's debt becomes the obligation of the combined entity. Because acquirers tend to be large and financially strong (see, e.g., Andrade et al. 2001 and Eckbo 2014), this is good news for target bondholders, who stand to make a capital gain (Billett et al. 2004). Such wealth transfer from (acquirers') shareholders to (targets') bondholders can discourage bids, just like it discourages greenfield investment in a single firm's case. Our main line of investigation examines whether callable bonds in a potential target's capital structure limit gains transferred to bondholders of targets and encourage takeovers. Since takeover acquisitions are harder to anticipate in advance for the managers (of the eventual target) than

[10] In Section 5.3, we show that bonds with make-whole provisions are traded above par much more frequently than callable bonds, consistent with the fact that make-whole calls do not limit creditors' upside.

capital expenditures, the results connecting callable debt to takeovers will also be arguably less affected by endogeneity than those related to capital investments.

4.1 Base Framework

The key intuition we explore builds the issue of splitting value gains — especially from positive-NPV projects — under state-contingent claims. Since the call price is predetermined (prior to the realization of the new investment opportunities), the value of callable bonds is effectively capped. With callable bonds in the capital structure, shareholders call their bonds when facing new, profitable investment opportunities. The gain to the bondholders from the new investment is limited to the *ex-ante* option value of the calls, reducing debt overhang problems. The shareholders' incentive to invest is thus closer to first-best with callable bonds than with non-callable bonds. We state this base working hypothesis formally:

Hypothesis 1. *A firm's investment will be less affected by debt overhang if its debt is callable.*

4.2 The effect of callability on acquisitions

Consider a finite-lived firm endowed with a cash flow-producing technology and a capital structure. There is no information asymmetry. We assume that the firm will produce cash flows at a single future date ($t = 2$) but disregard discounting with time. Cash flows in period 2 can be low (L) or high (H): $c^{stand-alone} \in (c_L, c_H)$, where $0 < c_L < c_H$. The probability of the high state occurring is $\phi \in (0, 1)$. The firm's capital structure is characterized by debt with face value $D \in (c_L, c_H)$. The debt face value can be understood to encompass both face value and coupon payments. Debt is senior, but cash flows are insufficient to repay debt in the low state. Accordingly, debt is risky. We assume the firm is owned by a single value-maximizing shareholder.

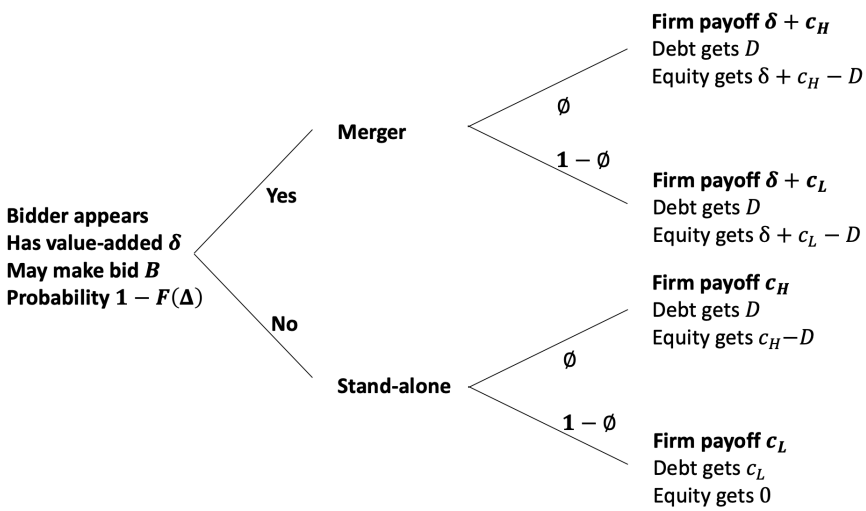

Figure 4. Model timing

The timing of the model is illustrated in Fig. 4. At time zero ($t = 0$), a possible acquirer appears. The bidder can buy the firm by making a take-it-or-leave-it offer B for all of the firm's equity, which the owner can accept or reject. If a deal goes through, the joint firm's cash flows are higher than stand-alone cash flows by δ, so that total payoff is: $c^{target} \in (\delta + c_L, \delta + c_H)$. Value-added ϕ is known to both the owner and the bidder. For tractability, we assume that δ is drawn from a distribution F with $\delta > D - c_L$.[11] All agents are risk-neutral and maximize expected payoffs. Note that the first best is to do all mergers since δ is assumed to be positive (value-reducing bidders would never make winning bids, so this is without loss of generality).

The analysis that follows considers two cases: a target firm with all straight (non-callable) debt and one with all callable debt.

[11]The value-added can be thought of as synergies, with the following caveat: we are assuming that pre-transaction creditors have recourse to the value-added cash flows. It may even be the case that target creditors also have recourse to bidder assets in general. This would strengthen the mechanism we study by making mergers even more value-improving for creditors.

4.2.1 Straight debt

To solve the model, we first consider pre-bid claimants' outcomes conditional on a decision. We then deduce the optimal decision given a bid and, finally, examine the acquirer's bid. If the shareholder says no to the bid, debt is worth $\phi D + (1-\phi)c_L$, and equity is worth $\phi(c_H - D)$, adding up to enterprise value (expected total cash flows) $\bar{c} = \phi c_H + (1-\phi)c_L$. If the bid is accepted, debtholders receive D, and the acquirer receives the expected payoff $\delta + \bar{c} - D$. The gain to debtholders from the bid is $\Delta \equiv D - \phi D + (1-\phi)c_L = (1-\phi)(D - c_L)$.

The bidder has bargaining power since she can make take-it-or-leave-it offers. Thus, the lowest acceptable offer will be made: $B = \phi(c_H - D)$. The net payoff for the bidder is $\delta + \bar{c} - D - B = \delta - \Delta$. The probability that a successful bidder will appear is $1 - F(\Delta)$. This is less than 1, indicating that some valuable bidders cannot make a winning bid. The extent of inefficiency is given by $F(\Delta)$, which is increasing in the likelihood of the bad state $(1-\phi)$ and the severity of that bad state $(D - c_L)$. This captures the debt overhang problem: the bidder improves the value of debt by Δ, and this reduces the net value of the deal, thus discouraging any bids where the net value creation is below the transfer. As the probability of the low state approaches zero, the debt becomes risk-free, debt overhang disappears, and bid outcomes approach first best: $\lim_{\phi \to 0} 1 - f(\Delta) = 1$.

Before a draw of the bidder is known, we can value equity and debt. For debt, this value is $MVD = (1-F(\Delta))D + F(\Delta)(\phi D + (1-\phi)c_L) = D - F(\Delta)(1-\phi)(D - c_L)$. Debt is underwater and worth less than its face value. The gap to face value increases in proportion to how much debt overhang discourages deals and in the number of downside losses after a bidder has shown up but is unable to close a deal. Equity is worth $MVE = (1 - F(\Delta))B + F(\Delta)(\phi(c_H - D) = \phi(c_H - D)$, representing the upside value without a merger (all the benefits of the merger are extracted by the bidder and debtholders). We can state the following about straight debt:

Result 1. *Debt overhang discourages bids for firms with risky straight debt, reducing the likelihood of successful takeovers. Ex-ante firm value is reduced as a result.*

The point of this result is two-fold. First, it establishes that debt overhang discourages value-enhancing takeovers, just like it discourages investment. Second, this is value-destroying *ex ante*, suggesting that firms will take action to avoid it. One simple solution is to avoid debt altogether (cf. Myers 1977). We point to a second solution: the use of debt that can be called. In the next section, we add a call feature to the firm's outstanding debt.

4.2.2 Callable debt

We now consider how a right to call can reduce the debt overhang generated by risky debt. We assume debt can be called at some level $X < D$. This assumption implies that the debt will always be called just before repayment since repayment would be more expensive than calling. In other words, debtholder will never get D, at most X. By construction, $\delta + c_L > X$, so that debt is always called after takeover. Importantly, however, the implications on the model would be similar if the debt was called in only some states after a takeover.

The analysis follows the same steps as before. The bidder will at most bid $B_{call} = \phi(c_H - X) > \phi(C_H - D) = B$. The net gain for the bidder is $\delta + \bar{c} - X - B = \delta - \Delta_{call}$, where $\Delta_{call} \equiv (1 - \phi))(X - c_L)$ is the gain creditors realize when a successful bid is made. The probability of a successful merger is now $1 - F(\Delta_{call}) > 1 - F(\Delta)$. The inequality follows from the fact that $\Delta_{call} < \Delta$ and the fact that F is an increasing function (cumulative distribution)

In the first period, the callable debt is worth $MVD_{callable} = X - F(\Delta_{call})(1 - \phi)(X - c_L)$. Equity is worth $MVE_{callable} = \phi(c_H - X)$. The cost for the firm to replace the debt with callable debt is $MVD - MVD_{callable}$, and the most equity holders would be willing to pay is $MVE_{callable} - MVE$. As long as the latter exceeds the former, the firm will replace straight debt

with callable. In fact, this is always the case: $MVE_{callable} - MVE - (MVD - MVD_{callable}) > 0$. This follows from the underlying economics: with callable debt, more value-increasing takeovers are realized. Coasian bargaining *ex-ante* (i.e., paying creditors to accept a call feature) ensures efficiency. We summarize the key properties of the model with callable debt as follows:

Result 2. *The value of callable debt increases less from takeovers than the value of straight debt. As a result, callable debt reduces debt overhang and increases the likelihood of successful takeovers.*

This result suggests that merger gains are smaller for callable bonds of the targets than for non-callable bonds, and firms with callable debt are more likely to be takeover targets than they would have without callable debt. We formalize this prediction as follows:

Hypothesis 2. *Firms with callable debt should be more frequent targets in acquisitions, and such acquisitions should benefit target debtholders less.*

To test this hypothesis, we compare merger announcement returns of different types of bonds and look at frequencies of takeovers for different groups of firms. We zero-in on firms whose callable bonds are on either side of the end of the "call protection period" (a contractually pre-determined time window) to draw inferences about bond callability. We also examine deregulation events associated with spikes in M&A activity for the same purpose.

5 Evidence on the real effects of bond callability

The results in Section 3 show that the upside value in callable debt is limited. The key prediction of the credit view of callable bonds is that firms with callable bonds should be more willing to undertake additional investment because less value is "leaked" to debt holders. This is the mechanism developed more formally in the previous section. In this section, we present empirical tests of our theory.

5.1 Debt overhang in takeovers: bond announcement effects

Using panel data for publicly listed firms, we examine whether callable debt is associated with higher takeover probabilities. To handle the endogeneity of callable debt, we focus on changes in takeover incidence around initial call dates. Because acquisitions are large events with identifiable timing, it is possible to analyze announcement returns of the target's debt, and thereby document how callable debt changes takeover dynamics. Below, we first analyze announcement returns and then takeover incidence.

We first compare merger gains differences between callable and non-callable bonds of targets of successful acquisitions. Following Kedia and Zhou (2014), we identify bond returns around acquisitions using transaction data in TRACE. We estimate the following regression:

$$R_{i,k} = \alpha + \beta \times Callable_{i,k} + \theta_i + \varepsilon_{i,k} \tag{1}$$

where the dependent variable, $R_{i,k}$, is the return of target firm i's k^{th} bond from one day before the acquisition announcement to five trading days after. We assign the dummy variable, "Callable", a value of 1 if a bond is fixed-price callable and has entered its call-period at the time of the announcement, and 0 otherwise. As firm characteristics vary between firms that issue callable and non-callable bonds (for example, issuing callable bonds is more common among less creditworthy firms), we include issuer fixed effects in all our specifications to isolate the effect of callability from the choice of issuing callable bonds. Our estimates are thus identified with announcement returns for firms that have *both* callable and non-callable bonds (including make-whole and callable bonds that aren't callable yet). The results are presented in Table 5.

[TABLE 5 ABOUT HERE]

In columns 1 through 4, we vary requirements concerning recency and frequency of trades

in TRACE, as well as instrument maturity. The average announcement return in our sample is 3.1%, pointing to significant merger gains generally accruing to creditors of target firms. Notably, callable bonds have between 6.7% and 4.2% lower announcement returns than bonds that are not callable (see row 1), which *negates gains* on the announcement of merger bids: mergers are good news for holders of non-callable bonds, but not for holders of callable bonds.[12] This base result is consistent with the theory that callable debt protects against debt overhang by limiting "leakage" of value to debtholders.

5.2 Takeover incidence: matched samples around first call dates

We turn to tests of a central prediction of our model: firms with callable debt are more likely to be targets of acquisitions. The identification strategy has to address that, since issuing callable bonds is a choice, issuers of callable bonds are likely to differ from other firms. We exploit a unique feature of callable instruments to reduce such concerns. To wit, callable bonds have an initial period when they are *not callable*, the "call protection period." This period is often half the bond maturity and is specified at the time of issuance. We separate firms that have all issued callable bonds into a group of firms that have passed the first call dates (referred to as "Callable") and another group that is still in the protection period (referred to as "Not yet callable"). As we contrast Callable with Not yet callable instruments, potential sources of endogeneity associated with the issuance of callable bonds and takeover probabilities are naturally eliminated. In this way, the protection period creates plausibly exogenous variation in callability.

For estimation purposes, we define the "Callable" group to be those firm-year observations where some bonds have passed the first call date. The Callable dummy equals 1 if the firm's bonds are at least 20% callable in year t, and equals 0 if its bonds remain not yet callable in year

[12] Acquisitions are generally seen as credit-positive events for target bondholders (see, e.g., Billett et al. 2004). Our results are new in showing that callable bonds limit the gains to target debtholders.

t and $t+1$. We use nearest neighborhood matching to select up to 5 control firms within the same Fama-French 12 industry and year that are closest in Book assets (log), Leverage, Tobin's q, Age, the shares of bond debt that is callable (for the treated group) or not yet callable (for the control group), and the HY issuer rating indicator.

Table 6 presents the pre-matching and post-matching differences in key characteristics between the Callable group and the Not yet callable group. As shown in Panel A, the differences are small and statistically insignificant even before matching. This reflects the advantage of our identification strategy in eliminating selection concerns regarding the issuance of callable bonds. After matching is performed, as shown in Panel B of Table 6, the differences become smaller in magnitude and remain statistically insignificant. This result further ensures that our results are not due to differences in firm characteristics that may affect takeover probability.

[TABLE 6 ABOUT HERE]

We initially estimate the linear probability of takeover on this matched sample using the following specification:

$$Target_{i,t} = \alpha + \beta \times Callable_{i,t-1} + \gamma \times Controls_{i,t-1} + \theta_{j,t} + \varepsilon_{i,t} \tag{2}$$

where i denotes firm and j denotes its industry. The results are presented in Table 7.

[TABLE 7 ABOUT HERE]

Column 1 of Table 7 shows that firms in the "treated group," i.e., firms whose bonds have become callable, have a 1.4% higher probability of being acquisition targets in the following year. Note that our tests control for (Fama-French 12) industry-year fixed effects and firm-matched characteristics (including Book assets, q, Leverage, and Age).[13] To account for the fact

[13] Our results are robust to alternative industry classifications (three-digit SIC, FF30, and FF48), thresholds to define the Callable dummy, and longer event windows for takeovers.

that the two groups could also differ in respects such as bond maturity and covenant inclusion, we also control for the average initial tenor of the bonds for each firm and a dummy variable indicating whether the firm's bonds have covenants.

The next column presents results for a Cox proportional hazard model, which shows that firms with callable bonds have a 44% higher hazard rate of being acquisition targets. The base hazard rate for firms whose bonds are not yet callable is 3% in our sample, so this agrees with the linear probability model.

By examining cases where a portion of outstanding bonds become callable, we cover a larger sample. However, the expected impact is smaller. As a "sharper" alternative, we examine firm-year observations where a firm's entire stock of outstanding bonds becomes callable. Columns 3 and 4 of Table 7 report results. The OLS regression predicts a 1.9% increase in annual probability of a takeover, and the Cox proportional hazard model predicts that the takeover likelihood increases by 55%, when all of a firm's bond debt becomes callable.

Many firms' liabilities include both bonds and bank loans. To isolate observations where the bond debt is particularly important in the debt structure, we examine a subsample of firms whose bond debt exceeds 50% of total debt. We again match firms that are in the "Callable" group with those in the "Not yet callable" group. Table 8 reports the same set of regressions as Table 7 for this narrower sample. Point estimates are slightly higher than for the wider sample in all four specifications, and are significantly different from zero (OLS) or one (Cox). Taken together, our results show that callable bonds facilitate takeovers. They imply that wealth transfers from acquirer shareholders to target bondholders is less of a concern when debt is callable.

[TABLE 8 ABOUT HERE]

Our identification strategy uses the protection period that is standard in length and predetermined at issuance, and contrasts takeover probabilities for similar firms on opposite sides

of the boundary. One potential concern is that firms with an interest in becoming acquired may align the timing of the first call date on their bonds with future merger opportunities. This is likely far-fetched, since first call dates are determined at bond issuance and is usually set in as a standard fraction of bond life. We still explore two additional identification strategies to get around this concern. We first use bonds with make-whole provisions as a "placebo" and test whether the evidence disappears with make-whole bonds. We present the results in Section 5.3. The second way to get around the concern is to look at shocks to the amount of merger opportunities in an industry. In Section 5.4, we present evidence using a regulatory instrument.

5.3 Takeover incidence: placebo tests using make-whole bonds

We perform a placebo test using make-whole bonds to pin down that the real effects we document are driven by the ability of (fixed-price) callable bonds to limit wealth transfers to bondholders. Unlike fixed-price callable bonds, make-whole bonds require issuers to compensate bondholders for the maximum of the face value or the present value of lost coupons and principal discounted at a prevailing interest rate usually given by a benchmark risk-free rate plus a fixed spread that is below the issuer's credit spread. This means that the strike price of make-whole bonds will virtually never be below the market value (cf. Xu 2017 and Elsaify and Roussanov 2018) and that reduced issuer credit risk or a general credit spread compression will not trigger issuers to exercise their make-whole provisions. Accordingly, we predict that make-whole bonds are *not likely* to impact debt overhang.

We first compare secondary market prices of callable bonds (which face a price ceiling determined at the time of issuance) and make-whole bonds (which face a ceiling always above the market value). As shown in Fig. 5, bonds with make-whole provisions are traded above par much more often than callable bonds. For example, while only 2.4% (1.2%) of callable bonds

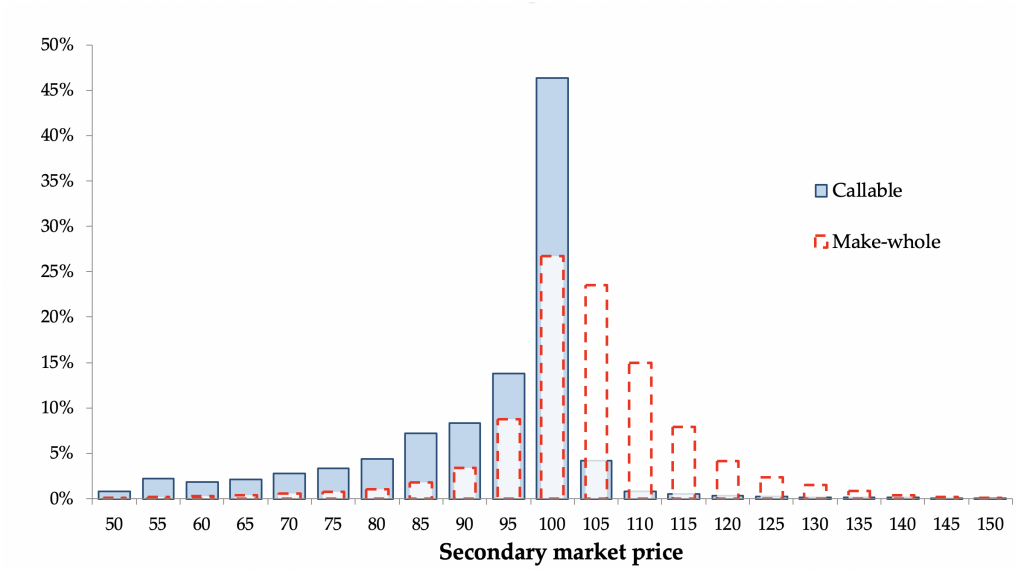

Figure 5. Secondary market prices of callable and make-whole bonds, 2007–2016. This figure presents the histogram of quarter-end prices of corporate bonds, 2007–16, constructed from the TRACE database. Bonds below $100 million of face value and with less than $1 million of transactions for the quarter are dropped. The column headings indicate interval midpoints in percent of par. In other words, "100" contains all bonds trading in the interval [0.975,1.025] of par value. "Callable" refers to a bond that with a fixed-price call provision and has reached its first call date and "Make-whole" refers to a bond with a make-whole provision.

trade above 1.075 (1.175 or more) times par, 32% (9.4%) of make-whole bonds do so. This result verifies that make-whole bonds do not limit the potential upside for bondholders.

Next, we repeat the main test in Section 5.2 using firms with make-whole bonds as a placebo group and compare their probability of being acquisition targets with the same control group as in the main test. The "Make-whole" dummy equals 1 if the firm's bonds are at least 20% make-whole callable in year t and the firm does not have 20% or more fixed-price callable bonds, and equals 0 if its bonds are not yet callable in year t and $t+1$. We use nearest neighborhood matching to select up to 5 control firms within the same Fama-French 12 industry and year that are closest in Book assets, Leverage, Tobin's q, Age, and the HY issuer rating indicator.

We estimate the linear probability of takeover on this matched sample to predict the proba-

bility of being acquisition targets in the following year as follows:

$$Target_{i,t} = \alpha + \beta \times Make\text{-}whole_{i,t-1} + \gamma \times Controls_{i,t-1} + \theta_{j,t} + \varepsilon_{i,t} \tag{3}$$

where i denotes firm and j denotes its industry. We also control for (Fama-French 12) industry-year fixed effects and the same set of firm characteristics at the time of matching, as in Section 5.2. The results are presented in Table 9.

[TABLE 9 ABOUT HERE]

Column 1 of Table 9 shows that firms in this "placebo group," i.e., firms whose bonds are make-whole callable, do not have a different probability of being acquisition targets in the following year, compared with matched firms in the control group. The coefficient is small in magnitude and statistically insignificant. We also find consistent results when estimating a Cox proportional hazard model (column 2), when examining firm-year observations where a firm's entire stock of outstanding bonds are make-whole callable (columns 3 and 4), and when restricting to a subsample of firms whose bond debt exceeds 50% of total debt (columns 5–8).

Our evidence suggests that, although make-whole bonds also give issuers an option to retire their bonds early, because they involve paying above par and market value, these calls do not limit wealth transfers to bondholders and therefore may not mitigate debt overhang.

5.4 Takeover incidence: evidence from deregulatory events

We dig deeper into the issue of identification and use deregulation as (pseudo-)natural experiments affecting merger events in our sample. We do so exploiting the enactment of Federal-level deregulation directly affecting entry, prices, and other elements of the industries' competitive environment, as well as the level of M&A activity (see Andrade et al. 2001, Ovtchinnikov 2013,

and Campello and Gao 2017). We are interested in examining whether a firm's bond callability affects its probability of being targeted in the affected industries post-deregulation.

Following the existing literature, we compile a list of industries witnessing transformative deregulation events between 1977 and 1996.[14] We consider the first deregulatory shock and firms' share of the callable bond prior to the shock. Since the timing and consequences of large deregulation events are hard to anticipate, it is less likely for firms to issue callable bonds several years in advance to facilitate subsequent acquisitions.

Our test sample includes firms in affected industries post-deregulation since before the deregulation event, entry-exits were restricted and M&A activity more muted. We estimate the following probability model:

$$Target_{i,t} = \alpha + \beta \times Callable_{i,t-1} + \gamma \times Controls_{i,t-1} + \theta_j + \varepsilon_{i,t} \tag{4}$$

where i denotes firm and j denotes the industry to which firm i belongs. The dependent variable, "Target", is a dummy that takes the value of 1 if 100% of the firm's shares was acquired by another firm in the year following the deregulation event, and 0 otherwise. Our main variable of interest, "Callable" is a dummy that equals 1 if the amount of the firm's callable bonds pre-deregulation exceeds 20% of all its debt, and 0 otherwise. We control for Book assets, Leverage, q, Age, all measured in the value prior to the deregulation. As shown in column 1 of Table 10, firms with more callable bond pre-deregulation have a significantly higher probability of being targeted in the post-deregulation window.

[TABLE 10 ABOUT HERE]

We also conduct a number of robustness checks of this important confirmatory finding.

[14] Earlier studies mostly obtain the initial deregulation list from Viscusi et al. (2005). The deregulation events are recently updated in Viscusi et al. (2018) to reflect those that occurred from 2002 to 2018.

In column 2, we change the post-deregulation window from 1 year to 3 years. In column 3, we change the threshold of "Callable" to 50%. In column 3, we use 3 years to define the post-deregulation window and 50% to define the "Callable" groups. The results are consistent with the baseline results in column 1. Overall, our estimations suggest that firms with a higher fraction of their debt callable before the deregulation have a higher probability of being taken over 1–3 years after deregulation, implying lower debt overhang in firms with callable bonds.

5.5 Capital investment

While the takeover market is a natural setting in which to tests the real effects of callability, our theory applies to capital investment as well. In this section, we relate investment to investment opportunity shocks as a way to uncover the role of callable bonds in reducing debt overhang. We limit our sample to high-yield issuers as the scope for debt overhang is larger for them. We treat capital expenditures, R&D, and advertising expenses as "investment" and examine, among firms with high-yield ratings, whether those with callable bonds invest more in capital and R&D when experiencing favorable investment opportunities.

To identify investment opportunity shocks, we use the annual intermediate input price changes at the industry level to capture the shocks originated from input costs.[15] We define high (low) investment opportunity, $HighOpp$ ($LowOpp$), to be a dummy that equals 1 if the percentage change in the industry input prices of the observation is among the firm's bottom (top) tercile, and 0 otherwise.[16]

We again utilize the call protection period for identification. The identifying assumption is that the exact timing of the protection period is not related to the desired response to the

[15] Intermediate inputs represent goods and services that are used in the production, such as intermediate energy, materials, purchased service input, labor compensation, etc.

[16] Input price changes are cost shocks to the firm. A more negative (positive) movement is associated with a favorable (unfavorable) investment opportunity.

investment opportunities. If firms with more callable bonds are different from others (within the same industry-year) in some unobserved way related to their investment behavior, these omitted factors play a limited role when we compare the capital investment of the "Callable" group with that of the "Not yet callable" group.

We first consider the "Callable" group to be those firm-year observations where partial bonds outstanding just passed the first call date. We use nearest neighborhood matching to select up to five control firms within the same Fama-French 12 industry and year that are closest in Book assets (log), Leverage, q, Cash flow, Age, and the share of bond debt that is callable (for the treated group) and not yet callable (for the control group). We estimate the following regression:

$$\begin{aligned} Investment_{i,t} = \alpha &+ \beta_1 \times HighOpp_{i,t-1} \times Callable_{i,t-1} \\ &+ \beta_2 \times LowOpp_{i,t-1} \times Callable_{i,t-1} \\ &+ \beta_3 \times Callable_{i,t-1} + \gamma \times Controls_{i,t-1} + \theta_{j,t} + \varepsilon_{i,t} \end{aligned} \tag{5}$$

where i denotes firm and j denotes the industry to which firm i belongs. We control for industry-year fixed effects and a number of firm characteristics (including cash flow and q) that affect investment. We also control for the average initial tenor of the firm's bonds, the remaining time to maturity, and a dummy variable indicating whether the firm's bonds have covenants. Our hypothesis predicts that $\beta_1 > 0$. The results are presented in Table 11.

[TABLE 11 ABOUT HERE]

We find a positive coefficient on the high investment opportunity and callable debt interaction term (see column 1 of Table 11). The evidence is consistent with our prediction that firms with more callable bonds are willing to invest more when experiencing favorable investment opportunities. The estimated magnitude is high: when at least 20% of bonds become callable, firms are able to scale up investment by an additional 1.7 percentage points, which accounts

for 18 percent of the average investment.

To mitigate the impact of loans and isolate observations where the bond debt is important in the debt structure, we examine a subsample of firms whose bond debt exceeds 50% of total debt. We find consistent evidence that firms with more callable bonds invest more when facing favorable investment opportunities (column 2 of Table 11). The estimated magnitude is slightly higher than for the baseline sample.

We then consider the second "Callable" group consisting of firm-year observations where the entire bonds outstanding become callable. Estimates in columns 3 and 4 imply that when 100% of bonds become callable, firms can raise investment by an additional 4 percentage points, which accounts for nearly 50 percent of their average investment. The results in Table 11 are consistent with the hypothesis that callable bonds reduce debt overhang and enable firms with high-yield issuer ratings to invest substantially more when facing favorable investment opportunities.

6 Concluding remarks

We document several novel facts about call features in U.S. corporate bonds. Callable bonds have higher yields at issue, but they rarely trade above par in the secondary market, with a "missing mass" just above par in the price distribution. Issuers are more likely to call their bonds after good news. This points to a broad view of call features, what we refer to as the "credit view," as opposed to the standard and narrower, "interest-rate view." One implication of the credit view is that callable debt may reduce agency costs of debt. We test this hypothesis in the context of mergers and acquisitions, where we document that callable bonds increase the likelihood that a firm will be the target of a bid and reduces the merger gains that flow to debtholders.

Our findings are critical in showing that a simple view of callability as a mechanism for allocating interest or duration risk between issuers and investors is incomplete. Call features

also adjust the *ex-post* distribution of upside between equity and debt and therefore change corporate behavior. As such, callable debt plays an underappreciated role in reducing the agency costs associated with corporate leverage. These benefits of call features can help explain why callable debt is so prevalent. Our results also point more broadly to the importance of understanding the details of financial contracting in order to draw inferences about the vibrancy and efficiency of corporate investment.

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Table 1. Selected summary statistics: bonds

The sample consists of corporate bonds in the Mergent FISD database. Financial refers to those bonds where the issuer belongs to the Fama-French industry "Finance". Non-financial refers to all other corporate bonds. Callability requires that the bond is callable at a fixed price for at least one year of the bond's life (see data section). Convertible bonds are excluded. Age refers to how long a bond has been outstanding when called, Remaining life the amount of time left until maturity, and Share of life is Age divided by total time until maturity at issue. Panel B and Panel C show summary statistics for non-financial corporate bonds.

Panel A. Callable bonds

	Number of bonds	Fraction callable	Fraction callable (v.w.)
Non-financial corporate bonds	53,127	35.5%	36.1%
Financial bonds	336,124	47.8%	51.1%
Non-financial corp. bonds, 1980-1999	20,214	38.7%	40.4%
Non-financial corp. bonds, 2000-2017	34,563	32.3%	32.5%
Non-financial corp. bonds, fixed coupon	47,453	37.0%	37.8%
Non-financial corp. bonds, floating coupon	4,952	25.8%	26.3%
Non-financial corp. bonds, IG	30,123	14.4%	12.9%
Non-financial corp. bonds, HY	16,168	76.0%	76.7%

Panel B. Bond features at call

	Mean	Std. dev.	Min	25th perc.	Median	75th perc.	Max
Age (years)	7.0	5.2	0	3.7	5.3	8.8	34.4
Remaining life (years)	7.9	8.3	0	2.6	4.7	10.0	91.9
Share of life	52%	24%	0%	33%	51%	70%	100%

Panel C. Bond features in bond panel data set

	Mean	Std. dev.	Min	25th perc.	Median	75th perc.	Max
Bond size (log $)	10.4	1.8	0	9.9	10.8	12.2	21.1
Remaining years	9.1	8.8	0	3	6	12	100
Age (years)	3.25	4.33	0	0	2	5	38
Issuer book leverage	0.44	0.24	0	0.25	0.42	0.61	0.95
Issuer debt/EBITDA	4.6	5.6	0	2.1	3.1	4.9	45.4
Issuer upgrade	0.10	0.30	0	0	0	0	1

Table 2. Selected summary statistics: firms

The sample consists of firms in the Compustat database, matched to Mergent FISD bond features and SDC merger data. The observations in this panel data set are firm-years. Callable bonds exclude bonds with call features but which are not yet at the first call date (such bonds are counted as non-callable here). Total assets are deflated to 2015 MUSD.

Panel A. Full sample

	Mean	Std. dev	25th perc.	75th perc.
Callable bond debt/ Total debt	0.007	0.067	0	0
Non-callable bond debt/Total debt	0.041	0.171	0	0
Leverage (Book)	0.297	0.391	0.038	0.404
Cash Flow	–0.043	0.508	–0.032	0.131
Tobin's q	2.740	4.258	1.028	2.543
Total assets (log)	0.592	2.801	–1.248	2.470
Age (since IPO)	11.872	11.854	4	16
Investment	0.087	0.208	0	0.092
Target	1.85%	13.51%	0	0

Panel B. Firms with positive callable bond debt

	Mean	Std. dev	25th perc.	75th perc.
Callable bond debt/ Total debt	0.316	0.344	0.048	0.507
Non-callable bond debt/Total debt	0.398	0.372	0	0.731
Leverage (Book)	0.433	0.276	0.274	0.540
Cash Flow	0.077	0.087	0.040	0.112
Tobin's q	1.558	1.340	1.037	1.676
Total assets (log)	3.751	1.872	2.520	4.810
Age (since IPO)	26.97	15.63	13	39
Investment	0.070	0.077	0.019	0.093
Target	2.99%	17.0%	0	0

Panel C. Firms with zero callable bond debt

	Mean	Std. dev	25th perc.	75th perc.
Non-callable bond debt/Total debt	0.034	0.155	0	0
Leverage (Book)	0.293	0.393	0.034	0.397
Cash Flow	–0.047	0.516	–0.037	0.132
Tobin's q	2.776	4.310	1.027	2.583
Total assets (log)	0.485	2.765	–1.320	2.321
Age (since IPO)	11.551	11.547	4	15
Investment	0.088	0.210	0	0.922
Target	1.83%	13.43%	0	0

Table 3. Yields at issue

This table presents the regression results of the yield at issue of individual non-convertible U.S. corporate bonds. The sample consists of non-financial fixed or zero-coupon corporate bonds in the Mergent FISD database issued between 1985 and 2017, issuing at least two bonds in the same month. Each observation is one bond issue. Size refers to the log of the total amount issued (in thousands of dollars). Maturity refers to the log of the initial tenor (in years). Covenant is an indicator for bonds with covenants reported in Mergent. Standard errors are reported under each coefficient. Credit quality (IG, HY) refers to issuer credit ratings. One star (*) indicates significance at the 10% level, two stars 5%, and three stars 1% level.

Dependent variable:	Yield to maturity		
Dep. Var. Mean (%):	6.016	6.016	6.191
	(1)	(2)	(3)
Fixed-price callable	**0.266*** **	-	-
	(0.056)		
Fixed-price callable (IG)	-	**0.137**	**0.162*** **
		(0.086)	(0.057)
Fixed-price callable (HY)	-	**0.395*** **	**0.387*** **
		(0.081)	(0.080)
Make-whole callable	**0.161***	**0.173** **	**0.131***
	(0.089)	(0.088)	(0.073)
Covenant	**0.075**	**0.064**	**0.057**
	(0.087)	(0.087)	(0.059)
Year-month F.E. x Maturity	No	Yes	Yes
Year-month F.E. x IG	Yes	Yes	Yes
Year-month F.E. x Duration	Yes	Yes	Yes
Year-month-issuer F.E.	Yes	Yes	No
Year-issuer F.E.	No	No	Yes
Clusters	Issuer, time	Issuer, time	Issuer, time
R-squared	0.984	0.984	0.980
Observations	20,193	20,193	20,193

Table 4. Bond call decisions: the impact of credit quality

This table presents panel regressions of the incidence of call events for US corporate bonds. Each observation is a bond-year. The sample consists of non-financial corporate bonds in the Mergent FISD database issued between 1985 and 2017. The dependent variable is an indicator taking the value 100 (in percentage points) if a bond is called and zero otherwise. Firm controls are from Compustat. Change variables and the upgrade variable represent changes from t-2 to t-1. Standard errors are reported under each coefficient. One star (*) indicates significance at the 10% level, two stars 5%, and three stars 1% level.

Dependent variable:	Call (%)				
Dep. Var. Mean (%):	9.44	8.24	20.85	21.40	11.39
	(1)	(2)	(3)	(4)	(5)
Ratings change	**1.324*** **	-	-	**1.362** **	**1.043*** **
	(0.228)			(0.641)	(0.355)
Leverage dropped previous year (indic.)	-	**3.059*** **	-	**6.224*** **	-
		(0.624)		(2.150)	
Change in bond price	-	-	**0.296*** **	**0.257*** **	-
			(0.072)	(0.076)	
Face value, log	**–1.139*** **	**–1.122*** **	**0.388**	**0.185**	**–1.563*** **
	(0.378)	(0.315)	(0.672)	(0.606)	(0.565)
Bond age	**–0.592*** **	**–0.531*** **	**–0.332** **	**–0.364** **	**–1.014*** **
	(0.089)	(0.071)	(0.169)	(0.180)	(0.566)
Remaining life	**0.347*** **	**0.343*** **	**0.096**	**0.041**	**0.353*** **
	(0.073)	(0.069)	(0.184)	(0.244)	(0.155)
Duration	**0.830*** **	**0.755*** **	**0.208**	**0.310**	**1.199*** **
	(0.153)	(0.132)	(0.480)	(0.502)	(0.295)
Market-to-book	-	-	-	-	**1.706* **
					(1.042)
Enterprise value (log)	-	-	-	-	**2.897*** **
					(0.484)
Equity return (%)	-	-	-	-	**2.394*** **
					(0.653)
Year F.E.	Yes	Yes	Yes	Yes	Yes
Clusters	Issuer	Issuer	Issuer	Issuer	Issuer
R-squared	0.062	0.061	0.043	0.048	0.070
Observations	31,349	39,479	5,865	5,287	4,936

Table 5. Bond returns around merger announcements

This table presents regressions of bond announcement returns around M&A announcements. The dependent variable is defined as bond return from days -1 to $+5$ where day zero is the date of announcement. Returns are calculated with data from TRACE. Callable is defined using the variable "callable" in the Mergent FISD database and is equal to 1 for bonds that are fixed price callable at the time of the M&A announcement. The sample consists of bonds of target firms which has been traded during at least two days in the month leading up to the announcement and during at least two days during or after the merger announcement. All specifications include issuer fixed effects. In columns 2 and 4, we exclude bonds that have less than one year to maturity. In columns 3 and 4, we exclude bonds that have less than five trades in the month leading up to the announcement. The sample period spans from 2002 to 2017. One star (*) indicates significance at the 10% level, two stars 5%, and three stars 1% level.

Dependent variable:	Announcement return (-1,5)			
Dep. Var. Mean (%):	0.031	0.029	0.030	0.027
	(1)	(2)	(3)	(4)
Callable	**–0.067****	**–0.050****	**–0.062****	**–0.042****
	(0.028)	(0.021)	(0.030)	(0.021)
Issuer F.E.	Yes	Yes	Yes	Yes
Time to maturity restriction	No	Yes	No	Yes
Pre-event trades restriction	No	No	Yes	Yes
R-squared	0.352	0.349	0.352	0.350
Observations	571	535	504	471

Table 6. Characteristics around the first call date

This table reports the pre-matching and post-matching difference in firm characteristics between callable and not yet callable groups. The sample consists of firms in the Compustat database, matched to Mergent FISD bond features and SDC merger data. The "Callable" group includes firm-years in which bonds have passed the first call date – the callable share of bonds outstanding is at least 20%. The "Not yet" group includes firm-years in which bonds are not yet at the first call date. The initial callable sample is matched to issuers with not yet callable bonds using Fama-French 12 industry, Book Assets (log), Leverage, q, Age (log), the share of bond debt that is callable (for the treated group) or not yet callable (for the control group), and the HY issuer rating indicator. Total assets are deflated to 2015 MUSD. Means and differences are estimated within industry and year. T-statistics are reported in parentheses. One star (*) indicates significance at the 10% level, two stars 5%, and three stars 1% level.

Panel A. Pre-matching difference in characteristics

	Callable	Not yet	Difference	t-stats
	(1)	(2)	(1)-(2)	
Total assets (log)	3.336	3.567	–0.231	(–0.327)
Leverage (Book)	0.420	0.401	0.019	(0.181)
Tobin's q	1.722	1.679	0.044	(0.086)
Age (since IPO, log)	2.501	2.319	0.182	(0.607)
Callable (or not yet callable) share	0.860	0.786	0.073	(0.545)
HY issuer rating	0.627	0.589	0.038	(0.188)

Panel B. Post-matching difference in characteristics

	Callable	Not yet	Difference	t-stats
	(1)	(2)	(1)-(2)	
Total assets (log)	3.367	3.531	–0.164	(–0.510)
Leverage (Book)	0.403	0.393	0.010	(0.221)
Tobin's q	1.620	1.604	0.015	(0.085)
Age (since IPO, log)	2.498	2.399	0.098	(0.793)
Callable (or not yet callable) share	0.858	0.817	0.041	(0.732)
HY issuer rating	0.626	0.598	0.028	(0.350)

Table 7. Takeover probability: matched samples around the first call date

This table presents regressions of takeover probabilities, using matched samples around the first call date. The initial sample consists of Compustat firms that have issued callable bonds. Takeovers are identified using SDC. "Callable" is a dummy that equals 1 if bonds have passed the first call date – either the callable share of bonds outstanding is at least 20% (columns 1 and 2) or 100% (columns 3 and 4), and 0 otherwise. The initial sample is matched to issuers with not yet callable bonds using Fama-French 12 industry, Book Assets (log), Leverage, q, Age (log), the share of bond debt that is callable (for the treated group) or not yet callable (for the control group), and the HY issuer rating indicator. Each column contains a linear probability (OLS) or a proportional hazard model (Cox) of firms being successfully targeted in the subsequent year following matching. For all models, each firm is set with a single record of survival/failure (takeover). We control for (Fama-French 12) industry-year fixed effects, firm characteristics at the time of matching (including Book assets, q, Leverage, and Age), as well as the average initial tenor of the bonds for each firm and a dummy variable indicating whether the firm's bonds have covenants. Standard errors are clustered at the matched pair level. One star (*) indicates significance at the 10% level, two stars 5%, and three stars 1% level (this refers to a t-test relative to zero for the linear probability models and relative to one for the Cox models).

Dependent variable:	Target			
Dep. Var. Mean (%):	0.030	0.030	0.035	0.035
Model	OLS	Cox	OLS	Cox
	(1)	(2)	(3)	(4)
Callable	**0.014*** **	**1.442*** **	**0.019*** **	**1.551*** **
	(0.004)	(0.150)	(0.008)	(0.236)
Other characteristics	Yes	Yes	Yes	Yes
Matching				
Treatment	Partial	Partial	Entire	Entire
Control	Not yet	Not yet	Not yet	Not yet
Industry X Year F.E.	Yes	Yes	Yes	Yes
# of unique firms	1,841	1,841	1,284	1,284
Observations	29,244	29,244	10,854	10,854

Table 8. Takeover probability: firms whose bond debt exceeds 50% of total debt

This table presents regressions of takeover probabilities as in Table 7. The tests are implemented for a subsample of firms whose bond debt exceeds 50% of total debt. All variables are defined as in Table 7. Standard errors are clustered at the matched pair level. One star (*) indicates significance at the 10% level, two stars 5%, and three stars 1% level (this refers to a t-test relative to zero for the linear probability models and relative to one for the Cox models).

Dependent variable:	Target			
Dep. Var. Mean (%):	0.033	0.033	0.034	0.034
Model	OLS	Cox	OLS	Cox
	(1)	(2)	(3)	(4)
Callable	**0.022*** **	**1.667*** **	**0.032*** **	**1.988*** **
	(0.006)	(0.201)	(0.012)	(0.429)
Other characteristics	Yes	Yes	Yes	Yes
Matching				
Treatment	Partial	Partial	Entire	Entire
Control	Not yet	Not yet	Not yet	Not yet
Industry X Year F.E.	Yes	Yes	Yes	Yes
# of unique firms	1,256	1,256	764	764
Observations	16,643	16,643	5,632	5,632

Table 9. Placebo test: takeover probability of firms with make-whole bonds

This table presents regressions of takeover probabilities, using firm with make-whole bonds as the placebo group. The initial sample consists of Compustat firms that have issued callable bonds or make-whole bonds. Takeovers are identified using SDC. "Make-whole" is a dummy that equals 1 if firms do not belong to the callable group and have make-whole bonds – either the make-whole share of bonds outstanding is at least 20% (columns 1 and 2) or 100% (columns 3 and 4), and 0 otherwise. The initial sample is matched to issuers with not yet callable bonds, the same control group as in the main test, using Fama-French 12 industry, Book Assets (log), Leverage, q, Age (log), and the HY issuer rating indicator. Each column contains a linear probability (OLS) or a proportional hazard model (Cox) of firms being successfully targeted in the subsequent year following matching. For all models, each firm is set with a single record of survival/failure (takeover). Standard errors are clustered at the matched pair level. One star (*) indicates significance at the 10% level, two stars 5%, and three stars 1% level (this refers to a t-test relative to zero for the linear probability models and relative to one for the Cox models).

Sample	**All matched firms**				**Firms whose bond/debt exceeds 50%**			
Dependent variable:	Target				Target			
Dep. Var. Mean (%):	0.042	0.042	0.039	0.039	0.039	0.039	0.037	0.037
Model	OLS	Cox	OLS	Cox	OLS	Cox	OLS	Cox
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Make-whole	**0.005**	**1.141**	**0.001**	**1.006**	**0.009**	**1.254**	**–0.002**	**0.988**
	(0.005)	(0.130)	(0.006)	(0.146)	(0.008)	(0.214)	(0.008)	(0.218)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Matching								
Placebo Treatment	Partial	Partial	Entire	Entire	Partial	Partial	Entire	Entire
Control	Not yet	Not yet	Not yet	Not yet	Not yet	Not yet	Not yet	Not yet
Industry X Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# of unique firms	1,775	1,775	1,492	1,492	1,210	1,210	962	962
Observations	23,636	23,636	17,106	17,106	13,230	13,230	9.238	9,238

Table 10. Takeover probability around deregulatory events

This table reports regressions of takeovers probability around deregulations. The sample includes firms from 4-digit SIC industries that were deregulated between 1977 and 1996. The dependent variable, Target is a dummy equal to 1 if 100% of the firm's shares were acquired in one year (or three years) following the deregulation, and 0 otherwise. In columns 1 and 2, Callable is a dummy that equals 1 if the amount of the firm's callable bonds pre-deregulation exceeds 20% of all its debt. In columns 3 and 4, the threshold is 50%. We control for Book assets (log), Leverage (book), q, Age (log), all in the year prior to the deregulation. All models include (4-digit SIC) industry fixed effects. One star (*) indicates significance at the 10% level, two stars 5%, and three stars 1% level.

Dependent variable:	Target			
Dep. Var. Mean (%):	0.013	0.045	0.013	0.048
Model	OLS	Cox	OLS	Cox
	(1)	(2)	(3)	(4)
Callable	**0.134***** (0.041)	**0.168**** (0.077)	**0.286***** (0.055)	**0.337***** (0.112)
Other characteristics	Yes	Yes	Yes	Yes
Industry F.E.	Yes	Yes	Yes	Yes
Sample				
Treatment	$Callable > 20\%$	$Callable > 20\%$	$Callable > 50\%$	$Callable > 50\%$
Control	None	None	None	None
Post-event window	1	3	1	3
R-squared	0.352	0.359	0.472	0.396
Observations	83	88	79	84

Table 11. Investment and callable debt: matched samples around the first call date

This table presents the results on investment using matched samples. The initial sample consists of Compustat firms with high-yield issuer ratings that have issued callable bonds. For each firm-year observation, Callable is a dummy that equals 1 if bonds become callable – either the callable share of bonds outstanding increases from 0 to at least 20% (columns 1 and 2) or to 100% (columns 3 and 4), and 0 if the bonds remain not yet callable. The initial sample is matched to issuers with not yet callable bonds using (Fama-French 12) industry, Book Assets (log), Leverage, q, Cash flow, Age (log), and share of bond debt that is callable and not yet callable. The dependent variable is investment, measured by the sum of capital expenditure, R&D expense, and advertisement expenses. HighOpp (LowOpp) is a dummy that equals 1 if the percentage change in the industry input prices of the observation is among the firm's bottom (top) tercile, and 0 otherwise. We control for Leverage, Cash flow, q, Book assets (log), the initial tenor of the firm's bonds, remaining time to maturity, and an indicator for covenants. Independent variables are lagged one year. All models include Year X industry fixed effects. Standard errors in parentheses are clustered at the matched pair level. One star (*) indicates significance at 10%, two stars (**) 5% and three stars (***) 1% level.

Dependent variable:	Investment			
Dep. Var. Mean (%):	0.093	0.095	0.081	0.079
Sample	ALL HY	$Bond/debt$ $>= 50\%$	ALL HY	$Bond/debt$ $>= 50\%$
	(1)	(2)	(3)	(4)
HighOpp X Callable	**0.017***	**0.023****	**0.036*****	**0.039****
	(0.009)	(0.011)	(0.014)	(0.017)
LowOpp X Callable	**0.004**	**–0.001**	**0.002**	**0.000**
	(0.009)	(0.011)	(0.011)	(0.012)
Callable	–0.012**	–0.005	–0.009	–0.005
	(0.006)	(0.008)	(0.009)	(0.011)
Other characteristics	Yes	Yes	Yes	Yes
Matching				
Treatment	Partial	Partial	Entire	Entire
Control	Not yet	Not yet	Not yet	Not yet
Industry X Year F.E.	Yes	Yes	Yes	Yes
# of unique firms	901	693	595	452
Observations	6,092	4,447	2,476	1,761