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

Bo Becker† Murillo Campello‡ Viktor Thell§ Dong Yan‖

May 9, 2022

Abstract

We show that callable bonds have both higher yields and lower market prices than matched non-callable bonds of the same issuer, reflecting the value of call features to issuers and investors. This "value of callability" as well as the inclusion and the exercise of call rights are jointly determined by issuer-specific credit quality. Our agency-based theoretical and empirical analyses further show that callability reduces debt overhang in corporate merger activity. Our results help explain the value and increasing prevalence of callable bonds in credit markets.

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

*We thank Martin Fridson, Andrew Kalotay, Raj Iyer, Brandon Julio, Gaurav Kankanhalli, Gustavo Schwenkler, Alexei Tchistyi, Philip Valta, as well as seminar participants at the Adam-Smith Workshop, CEF Workshop, CICF, CAIFC, Colorado State University, Copenhagen Business School, DePaul, Gothenburg, Groningen, HEC-McGill Winter Finance Workshop, Nanyang Technological University, SAIF, Singapore Management University, Utrecht, the Swedish House of Finance, and IFN for comments and suggestions. Becker and Yan wish to acknowledge financial support from "Jan Wallanders och Tom Hedelius Stiftelse."

†Stockholm School of Economics, CEPR and ECGI, Stockholm, Sweden. bo.becker@hhs.se.

‡Cornell University and NBER, Ithaca, NY, United States. campello@cornell.edu.

§Swedish FSA, Stockholm, Sweden. viktor.thell@fi.se.

‖Stockholm School of Economics and CEPR, Stockholm, Sweden. dong.yan@hhs.se.

1 Introduction

U.S. companies have relied on callable bonds to lever up. From 2000 to 2020, the share of callable bonds grew from 35% to 89% of new corporate bond issues (see top panel of Fig. 1). The average yield on callable bonds exceeds that of non-callable bonds by 27 bps at issue (holding issuer identity constant). Together with higher at-issue yields, callable bonds also trade at relatively lower secondary market prices. This *high yield–low price* combination is consistent with the argument that (1) the market compensates bond investors for the option value embedded in callable instruments through higher yields *at issue* and (2) calls impose a cap on bond prices *after issue*. Under this argument, bond call features should be particularly valuable in times of high volatility. Indeed, the issuance of callable bonds has spiked both during the 2000–1 recession, the Financial Crisis, and the Covid-19 Crisis (bottom panel of Fig. 1).

Current research has been silent on why bond callability is so common and valuable. Descriptions of calls in textbooks and industry accounts still stress that callability bundles an interest rate option with a straight bond. To wit, when the Treasury yield curve shifts down, firms should call 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." Alternative views on call rights suggest that they are used to allow firms to reissue debt with different covenants (King and Mauer 2000 and Green 2018), force bond conversions (Mayers 1998), or to change the maturity structure of outstanding obligations (Xu 2018 and Elsaify and Roussanov 2018). Under the "re-contracting view" of calls, the motivation for including call rights in a bond need not be tied to funding costs. Finally, one view stresses that companies have an incentive to call their debt when their own (firm-specific) credit risk drops or credit spreads tighten. We refer to this as the "credit view" of bond calls. This view connects debt calls to the agency costs of debt. Its argument is formalized in Diamond and He (2014), who show that callability reduces problems associated with debt overhang and that firm decisions are shaped by the ability to recall debt early.

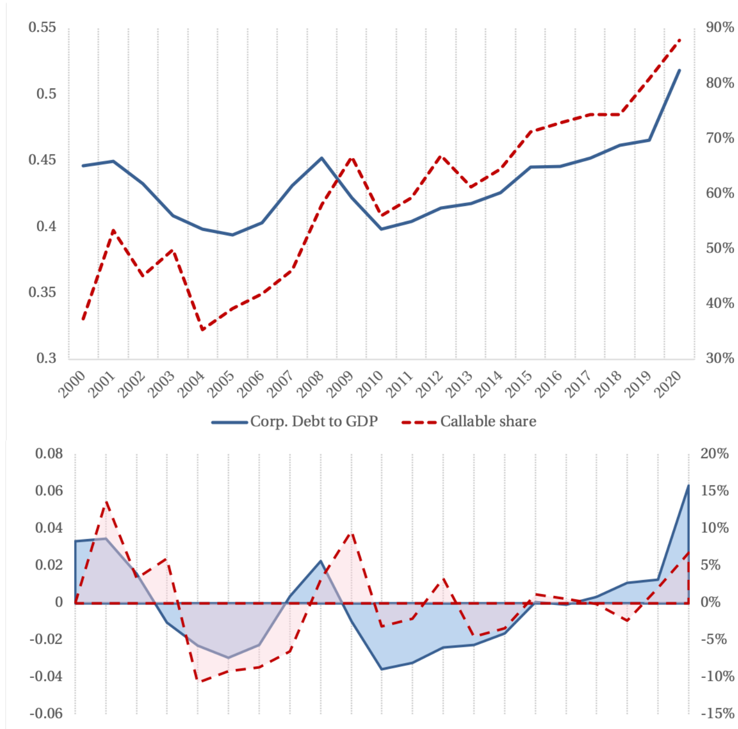

Figure 1. Callable share and leverage. This figure shows corporate debt (normalized by GDP) from U.S. Flow of Funds and the callable share of new bond issues from Mergent FISD. Top panel: levels (leverage on left-hand scale); bottom panel: detrended leverage and callable share. Both time series correlations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

This paper provides a comprehensive new assessment of callable bonds, focusing on distinct predictions of the credit view of call rights. We first formulate and test those predictions using information covering decades of life histories of U.S. corporate bonds together with data on secondary market bond prices. We further innovate by pushing forward agency-based explanations for calls. To do this, we characterize 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 firms' debt creates overhang for acquirers (discouraging mergers) and call provisions in targets' debt 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.

We show that the credit view finds strong, multi-faceted support in the data.[1] First, issuers' call decisions are highly predictable with non-interest factors. Notably, calls are predicted by positive changes to firms' *own credit quality*, such as rating upgrades and falling yields on bonds, which significantly raise call hazard rates holding time-series variables (interest rates and spreads) fixed. The call decision dynamics that we observe in the data are not predicted by the interest rate view of calls nor covenant- or maturity-based theories.

Second, post-issuance market prices of callable and non-callable bonds differ as predicted by the credit view. Under that view, calls should be triggered by value improvements (e.g., due to reduced issuer credit risk or credit risk premia). Accordingly, the distribution of secondary market prices should 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, characterizing this as a predicted price ceiling for many callable bonds (see Powers 2021). 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 identical 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. Competing views on calls are silent on bond price distributions.

Third, callable bonds should provide higher yields to bondholders as compensation for their limited (capped) future capital gains. We show 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 include controls for duration and maturity, as well as several other contract parameters (e.g., covenants and seniority), addressing concerns related to selection into issuance of callable debt. Our tests further show that the "value of callability" varies with issuer credit quality: investment-grade (high-yield) callable bonds have 17 (38) bps higher yields.

[1] We focus on "fixed-price" calls, which set a predetermined price level at which a bond can be called (see Tewari et al. 2015). Bonds can also have "make-whole" calls, which allow issuers to call at a price that depends on interest rates (see Brown and Powers 2020). We discuss shortly how we use make-whole calls for test identification.

Our study then connects callable bonds to real firm decisions. 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, nonetheless. First, foregoing profitable projects leaves few traces. Second, corporate debt structure is endogenous. We develop a model and test design to tackle these challenges using the corporate takeover market as a laboratory. Besides its novelty and relevance, as we discuss below, one advantage of the acquisition setting is its plausibly cleaner identification.

In our model, value transfers from acquirer shareholders to target bondholders discourage bids (just like value transfers discourage greenfield investment in leveraged firms). Callability limits the upside value of bonds. Accordingly, our model predicts that firms with callable bonds should be more frequently 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. In particular, callable debt strongly predicts whether a firm becomes a takeover target. And while non-callable bondholders witness significant positive returns upon takeover announcements (5-day CARs of 2%), matched callable bondholders do not. This finding is new to the literature and *negates* gains reported by earlier papers on the announcement of mergers, which posited that mergers are "credit positive events" for target bondholders.

To sharpen our test identification, we use the *ex-ante* contractually-set period when callable bond calls *cannot be exercised* — referred to as the "call protection period" — as a quasi-random treatment assignment. To wit, this period is ordinarily set to half of bond maturity at the time of issuance, which means that the time when it ends is pre-determined several years in advance and tied to maturity (see Xu 2018). Our tests compare the likelihood of becoming a takeover target for firms whose callable bonds are within the protection period — hence not yet callable — to matched bonds that become callable. We find that when 20% of the bonds issued by a firm become callable, the hazard rate of becoming an acquisition target increases by 44%. We further perform a series of placebo tests to shore up our inferences. We do so looking at firms whose bonds are make-whole callable. Notably, make-whole bonds *do not* place sharp limits on the upside value of debt.[2] As such, they still generate debt overhang problems and should not significantly affect merger probabilities. Indeed, that is what we find in the data. Going a step further in identifying the effects of interest, we examine merger activity around government-led deregulation initiatives (events that trigger large 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 look at bond issuers' capital expenditures. In particular, we study how firm investment spending 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 (cf., e.g., Dasgupta et al. 2018). We do so again by exploiting the *ex-ante* bond call protection period to help identify our tests. We find that callable debt predicts significantly larger investment responses (by one fifth of average investment rates) to favorable shocks to input prices. Consistent with agency-based considerations, debt callability increases the elasticity of investment to investment opportunities.

The narrow interest-rate view is often used as a framework under which to understand bond callability.[3] Our work shows that the broader credit view better explains the pricing of bonds *both* at issue and in secondary markets, as well as corporate decision making. Our work also demonstrates *how* the credit view connects callable bonds to debt overhang and real firm decisions. Together with other work linking call features to financial contracting, such as Mayers (1998), King and Mauer (2000), Elsaify and Roussanov (2018), Green (2018), and Xu (2018), our results suggest that debt callability is a key capital structure parameter — similarly to debt seniority and maturity — bearing important implications for observed corporate behavior.

[2]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 prevailing interest rates when calling. This means that reduced issuer credit risk or a general credit spread compression will also raise the strike price of make-whole bonds, allowing bond investors to share more upside potential.

[3]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).

The rest of the paper is organized as follows. Section 2 describes our data. Section 3 shows evidence on limits to the upside value of callable debt. Section 4 theoretically studies the interplay between callable debt and debt overhang, showing how bond callability affects mergers. Sections 5 and 6 present empirical results on the real effects of callable bonds. Section 7 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. 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 use the yield to maturity indicated in Mergent.

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.[4] Accordingly, 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

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

prices (typically issued in conjunction with warrants).[5] 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 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 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" as one for any firm that 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 daily bond price information from TRACE, M&A data from Thomson SDC, and bond features from Mergent FISD. We exclude bond trades with missing prices. We require bonds to have at least two days

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

with trading information over the four weeks leading up to the announcement. We also require bonds to have information on the offering amount and time to maturity. These filters result in a sample of 449 bonds issued by 112 target firms for the sample period from 2002 to 2017.

To identify investment opportunity shocks, we use annual price changes of intermediate inputs for each industry (see Dasgupta et al. 2018 for details). 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).

3 Issuer credit quality and callable bonds

This section provides novel evidence of the prevalence of callable bonds, their pricing, and the call behavior of issuers.

3.1 The prevalence of callable bonds and the value of calls

Fig. 2 summarizes the incidence of fixed-price call features in U.S. corporate bonds issued between 1970 and 2017, sorted by tenor at issue and credit rating. Notably, High-yield (HY) bonds of all maturities are typically callable. They contain call features far more often than Investment-Grade (IG) bonds: 76% *vs.* 14% of bonds. This suggests that credit risk motivates calls. In particular, note that 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. Calling these bonds implies precluding investors from reaping the benefits of increasing bond values.[6]

One can obtain an estimate of the "shadow cost" of callability using regression analyses. Our data contain 662 issuer-month observations where there is *both* a callable and a non-callable bond (a total of 3,331 bonds). The sample average yield difference between callable

[6]Fig. 2 shows that IG bonds of long maturities are often callable, which is also consistent with the credit view.

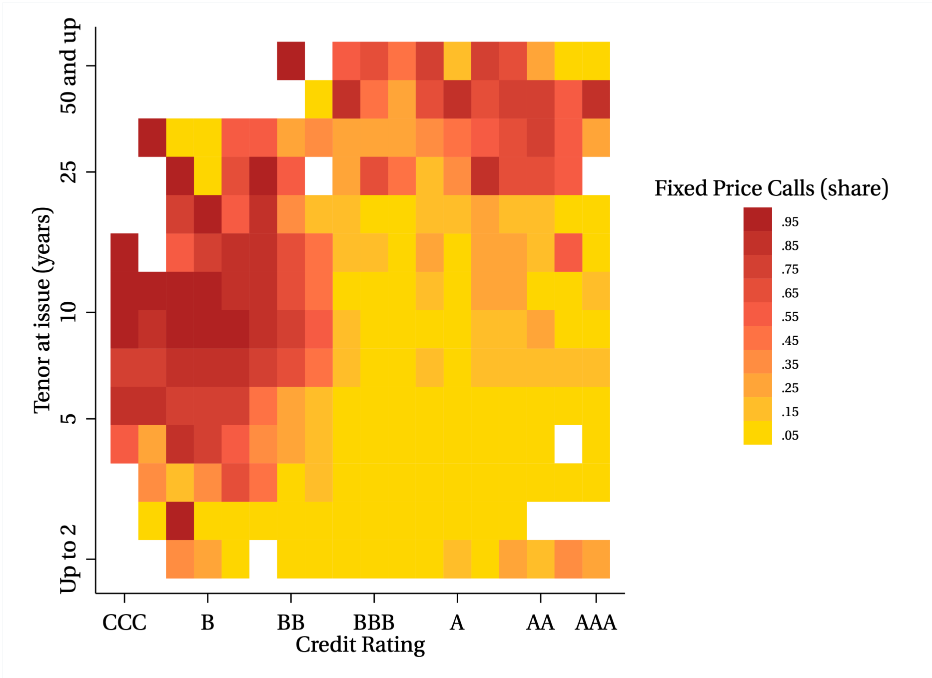

Figure 2. Callable bond issuance, 1970–2017. Cells indicate the share of non-financial corporate bonds issues that are fixed-price callable, double sorted by tenor (in years) and credit rating at issue.

and non-callable bonds is 2.5% (yield for callable bonds is 8.4% *vs.* 5.9% for non-callables).[7] This difference reflects the value of embedded calls, but also differences in duration, credit risk, and so on. To get closer to the value of calls, we compare bonds with different call features issued by *the same firm at a given month*, in a regression with controls for bond characteristics at issue, including bond size, maturity, a covenant indicator, a seniority indicator, and fixed effects for each combination of issuer and time (month-year). Differences in credit risk and possible selection bias should 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 at issue between bonds with the fixed-price call feature and those without is 27 bps. As a benchmark, make-whole calls are associated with 16 bps higher yields (only marginally statistically significant). Our estimate stresses that calls are quantitatively important to bond yields. Indeed, the 27 bps difference

[7] Bonds are normally issued at par. Consistent with this practice, we find that the two types do not differ in their offering prices, and the yield difference comes from higher coupons paid by callable bonds.

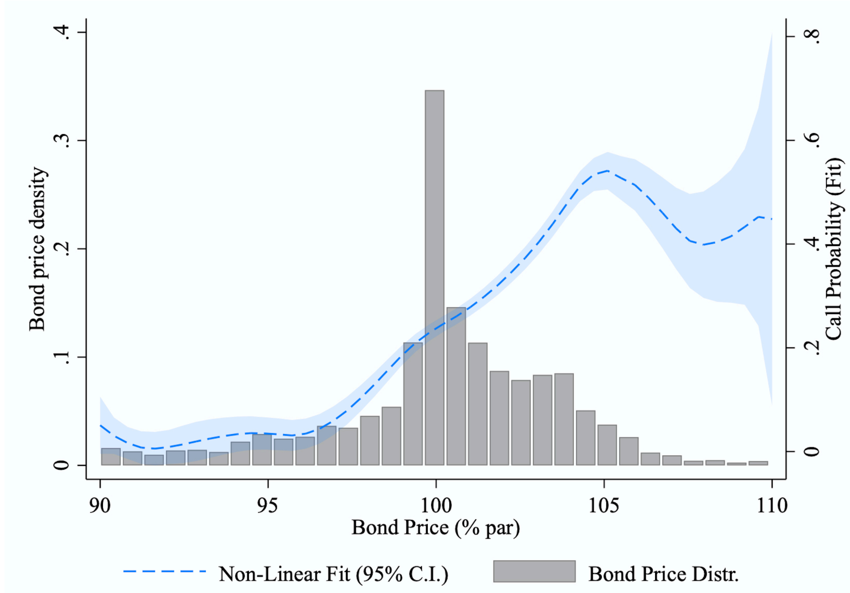

Figure 3. Bond prices and the likelihood of a call. This plot presents the estimated relation between the bond price at the previous year-end and the likelihood of a call in the following year. A locally smoothed, third-degree polynomial fit is estimated. A histogram of end-of-year secondary market bond prices is plotted for reference.

we estimate corresponds to the yield difference associated with a two-notch distance in credit ratings (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 is 17 bps for investment-grade bonds and 38 bps for high-yield bonds. The larger yield difference for bonds with worse ratings suggests that call features in bonds are more important for riskier issuers.

3.2 The decision to call a bond

The credit view posits that any factor pushing the price of a bond above its call price should raise the probability of a call — this could be falling rates, falling spreads, and improving issuer credit quality. In Fig. 3, 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 more than 40%.

We use regression analyses to tease out the impact of changes in interest rates, credit spreads, and issuer credit quality on call decisions. We do so using a linear probability model of call hazard rates, controlling for bond features such as bond size, age, remaining life, duration, covenant, and seniority. We also include year fixed effects, meant to absorb aggregate financial variation (interest rates, credit spreads, etc.) and macro-economic conditions. The results are in Table 4.

[TABLE 4 ABOUT HERE]

The variables of interest capture firm credit quality: changes in issuer credit ratings, market leverage changes, and bond price changes (all lagged). Each measure of firm credit quality significantly predicts future call decisions beyond interest rates and credit spreads. The estimated economic magnitudes are significant: a one-notch-rating upgrade (i.e., from A to A+) raises the call hazard rate by 1% (12% of the sample mean); a one-standard-deviation drop in leverage (11%) also raises the hazard rate by 1% (12% of the mean); and a 10-bps drop in the bond yield raises the call hazard by 3% (14% of the mean).

3.3 Callable bond price distribution

Given that prices are a strong trigger of calls, one would expect the distribution of secondary market prices for callable bonds outstanding at any point in time to be "thin" at high price levels. Fig. 4 confirms this hypothesis 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 price ceiling in the future); and (3) callable bonds (which currently face a price ceiling). As predicted, callable bonds are less often traded above par compared to *both* non-callable bonds and not yet callable bonds.[8] 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. Likewise, 1% of callable bonds trade above 1.175 times par, compared to 4% of not yet callable, and 8% of non-callable bonds. These data patterns make it clear that call provisions limit the potential upside for bondholders.

[8] Kolmogorov-Smirnov tests show that differences across price distributions are statistically highly significant. The data display similar patterns if we normalize the secondary market prices by the bonds' offering prices.

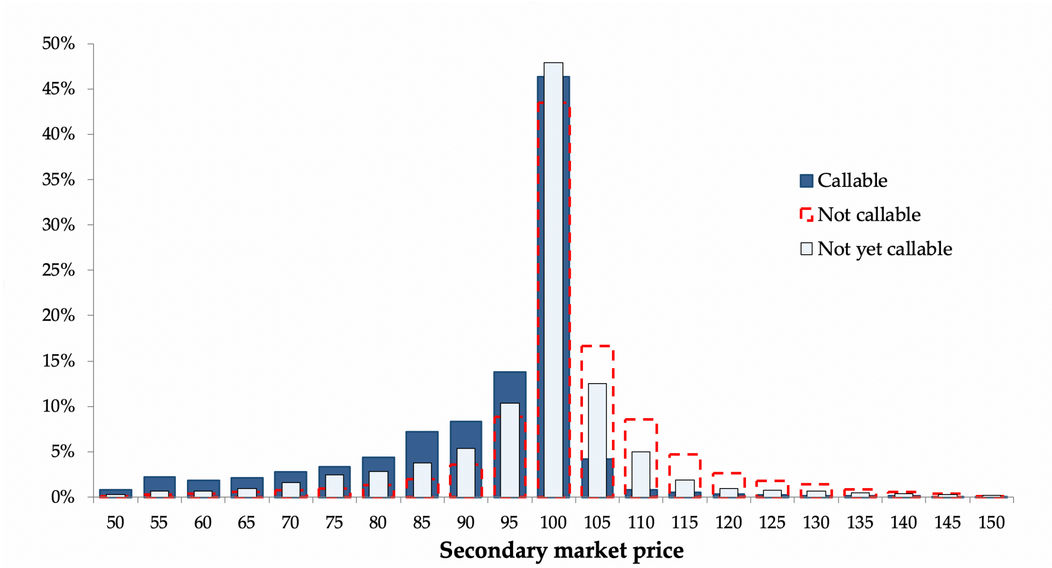

Figure 4. Secondary market prices of callable and non-callable bonds, 2007–2016. This figure presents the histogram of quarter-end prices of corporate bonds constructed from TRACE. Bonds below $100 million of face value and with less than $1 million of transactions for the quarter are dropped. The column 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. "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. "Callable" to a bond that has reached its first call date.

Our new, joint analyses of bond price and call data reveal substantial differences between callable and non-callable bonds of the same issuer: callable bonds are issued with higher yields but are quickly called when their secondary market prices rise. In practice, callable bonds do not provide their holders the same upside potential as non-callable bonds. We take our evidence of the credit view of calls a step further and study the real-side effects of bond callability in turn.

4 Modeling the effect of bond callability on mergers

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 corporate 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 seen as "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, Almeida et al. 2011, 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 target's capital structure limit gains transferred to bondholders of targets and encourage takeovers.

The key theoretical 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 lay out the details of our model in turn.

4.1 Set-up

Consider a finitely-lived firm endowed with a cash flow-producing technology and a capital structure. The firm is owned by a single value-maximizing shareholder and there is no information asymmetry. We assume that the firm will produce cash flows at a future date but disregard discounting with time. Future cash flows 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.

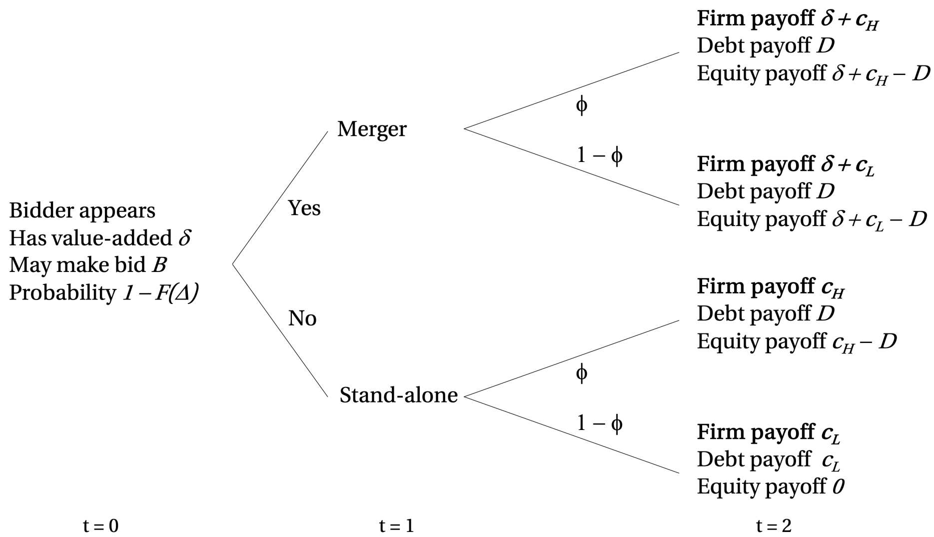

Figure 5. Model timing

The timing of the model is illustrated by Fig. 5. 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 at time one ($t = 1$). If a deal goes through, the joint firm's cash flows at time two ($t = 2$) 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 δ is known to both the owner and the bidder. For tractability, we assume that δ is drawn from a distribution F with $\delta > D - c_L$.[9] Agents are risk-neutral and maximize expected payoffs.

The analysis that follows considers two cases: a target firm with all straight (non-callable) debt and one with all callable debt. To solve the model under each of those cases, we first consider pre-bid claimants' outcomes conditional on a decision. We then deduce the optimal decision given a bid and examine the acquirer's bid.

[9]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 Straight debt

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 to 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 capital investment. Second, this is valuedestroying *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.

4.3 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, debtholders will never get D, at most X. By construction, $\delta + c_L > X$, so that debt is always called after a 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 been without callable debt. We formalize this prediction as follows:

Hypothesis 1. *Holders of callable debt in target firms should benefit less from acquisitions.*

Hypothesis 2. *Firms with callable debt should be more frequent targets in acquisitions.*

To test these hypotheses, we compare merger announcement returns of different types of bonds and look at frequencies of takeovers across 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 set, pre-determined* time window) to draw plausibly causal inferences about bond callability. We also use deregulation events associated with spikes in M&A activity for the same purpose.

5 Evidence on the effect of bond callability on mergers

In this section, we test our model's hypotheses. Because acquisitions are large events with identifiable timing, it is possible to analyze announcement returns of the target's debt and document how callable debt shapes takeover outcomes. Below, we first analyze announcement returns and then takeover incidence. We subsequently discuss and address threats to the identification.

5.1 Takeover announcement effects on bond prices

As a start, we 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:

$$R_{i,k} = \alpha + \beta_1 \times Callable_{i,k} + \beta_2 \times Not\text{-}yet\ Callable_{i,k} + \gamma \times Controls_{i,k} + \theta_i + \varepsilon_{i,k} \qquad (1)$$

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 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. We also include *Not-yet Callable*, a dummy variable that equals 1 if a bond has a fixed-price call feature but has not reached its call period at the time of the announcement. We control for bond characteristics such as bond size, remaining time to maturity, and bid-ask spreads. As fundamental company characteristics vary across firms that issue callable and non-callable bonds, 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. The results are shown in Table 5.

[TABLE 5 ABOUT HERE]

We report estimates from models with varying requirements concerning recency and frequency of trades in TRACE, as well as instrument maturity. For a six-day window, the average announcement return in our sample is 1.6%, pointing to significant merger gains generally accruing to creditors of target firms. Notably, callable bonds have between 3.2% and 3.4% *lower* announcement returns than bonds that are not callable (see row 1). In comparison, not-yet callable bonds do not exhibit statistically significant differences in announcement returns relative to non-callable bonds. Since the bond market is less transparent and liquid, we also examine a longer event window from five days before the acquisition announcement to fifteen days after. We find more pronounced return differences between callable bonds and non-callable bonds. Our finding is new to the literature and *negates* some of the gains reported by earlier papers on the announcement of mergers.[10] In particular, mergers are good news for holders of non-callable bonds, but not for holders of callable bonds. This finding is consistent with the theory that callable debt protects against debt overhang by limiting "leakage" of value to debtholders.

[10] Acquisitions are seen as credit-positive events for all target bondholders (see, e.g., Billett et al. 2004).

5.2 Takeover incidence

5.2.1 Base test

We turn to tests of a central prediction of our model: firms with callable debt are more likely to be targets of acquisitions. We first test this hypothesis using firm-year panel data. The outcome variable, *Target*, is assigned a value of 1 if the firm is the object of a successful takeover, and 0 otherwise. We use *Callable Bond Debt*, computed as the value of callable bonds normalized by the firm's total debt, to measure the share of debt that is callable. Similarly, *Not-yet Callable Bond Debt* and *Non-callable Bond Debt* (both normalized by the firm's total debt) measure the share of debt that has call features but that has not yet reached the first call date and the share of debt that does not have call features, respectively.

We estimate the linear probability of takeover using the following specification:

$$\begin{aligned} Target_{i,t} &= \alpha + \beta_1 \times Callable\ Bond\ Debt_{i,t-1} + \beta_2 \times Not\text{-}yet\ Callable\ Bond\ Debt_{i,t-1} \\ &+ \beta_3 \times Non\text{-}callable\ Bond\ Debt_{i,t-1} + \gamma \times Controls_{i,t-1} + \theta_{j,t} + \varepsilon_{i,t} \end{aligned} \tag{2}$$

where i denotes a firm, j denotes its industry, and t the year of observation. We control for (Fama-French 12) industry-year fixed effects and firm characteristics such as Book assets, q, Leverage, Age, the average initial tenor of the bonds, and a dummy variable indicating whether the firm's bonds have covenants. The results are presented in Table 6.

[TABLE 6 ABOUT HERE]

As shown in column 1 of Table 6, firms with higher callable bond debt are more likely to become takeover targets, whereas firms with non-callable bond debt are not. We further show in column 2 that the estimate on *Callable Bond Debt* remains statistically significant when controlling for relevant firm (e.g., leverage and size) and bond (e.g., tenor and covenants) characteristics. In comparison, bonds that are not yet callable do not significantly predict takeovers when firm and bond characteristics are included. We also estimate a proportional hazard

(Cox) model of being acquisition targets. The result, presented in columns 3 and 4 of Table 6, is consistent with the linear probability model. The estimated magnitudes are economically important: an increase in callable debt of 34.4% (one-standard deviation of the *Callable Bond Debt* variable for those firm-years where it is strictly positive) raises the takeover likelihood by 0.5–0.6 percentage points, or 14–19 percent of the average takeover probability.[11] These results are consistent with our model's prediction that firms with more callable bonds are more likely to become targets in takeovers.

Note that columns 2 and 4 of Table 6 include controls for leverage and other firm characteristics. Hence, our tests compare the takeover probabilities across firms with *similar leverage ratios* but *different proportions of callable bonds*. Still, since issuing callable bonds is a choice, issuers of callable bonds may differ from other firms in unobserved dimensions that affect takeover probabilities. We explore a novel identification strategy to address this concern in turn.

5.2.2 Matched samples around first call dates

We exploit a unique feature of callable instruments to identify the effect of callability. To wit, callable bonds have an initial period when they are *not callable*, the call protection period. This period is often set to half the bond maturity and is contractually 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 just-callable with not-yet callable instruments, potential sources of endogeneity associated with the issuance of callable bonds and takeover probabilities are naturally eliminated. Akin to a regression discontinuity design (RDD) approach, exploiting the protection period creates plausibly exogenous variation in callability among firms that have issued bonds with call features.

For testing, we assign to the "Callable" group those firm-year observations where some

[11] The baseline probability of firms being targeted is 3.5%. The point estimate in OLS (Cox) model is 0.019 (1.446). This implies that a one-standard deviation increase in *Callable Bond Debt* raises the takeover probability to $0.019 \times 34.4\% + 3.5\% = 4.1\%$ ($exp(ln(1.446) \times 34.4\%) \times 3.5\% = 4.0\%$); a 0.6 (0.5) percentage point increase.

bonds have passed the first call date. We first use 20% as our threshold and assign the Callable dummy a value of 1 if the firm's bonds are at least 20% callable in year t, and 0 if its bonds remain not-yet callable. As a "sharper" alternative, we also examine firm-years where a firm's entire stock of outstanding bonds becomes callable.[12] 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 further match firms on the share of bond debt that is callable (for the "treated group") or not-yet callable (for the "control group"). As such, our tests compare the probability of becoming a takeover target across firms with *similar proportions* of bonds with calls but *different abilities* to call their bonds.

Table 7 presents the pre-matching and post-matching differences in key characteristics between the Callable and the Not-yet callable groups. 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 7, 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 7 ABOUT HERE]

We estimate the following linear probability model of takeovers on our matched sample:

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

where i denotes a firm, j denotes its industry, and t the year of observation. Our estimations control for dynamic industry $\times$ year fixed effects and firm-matched characteristics. To account for the fact that the two groups could also differ across other characteristics of their bonds, such as bond maturity and covenant inclusion, we also control for the average initial tenor

[12] When using the 100% threshold, the "Callable" group tilts toward smaller firms with fewer bond issues. We show in Table A.1 that our results are robust if we use different thresholds (40%, 60%, and 80%) to define the Callable category. Our results are also robust to various alternative industry classifications (three-digit SIC, FF30, and FF48).

of the bonds for each firm and a dummy variable indicating whether the firm's bonds have covenants. The estimation results are in Table 8.

[TABLE 8 ABOUT HERE]

Column 1 of Table 8 shows that firms in the "treated group" (firms whose bonds have become callable) have 1.4 percentage points higher probability of becoming acquisition targets after at least 20% of their bonds become callable, which corresponds to a 46 percent increase in the probability of being taken over. The next column presents results for a Cox proportional hazard model showing that firms with callable bonds have a 44 percent higher hazard rate of becoming acquisition targets, which agrees with the linear probability model. Columns 3 and 4 of Table 8 report the results for firm-years where a firm's entire stock of outstanding bonds becomes callable. Takeover probabilities estimated under both the OLS and Cox hazard models become much higher when more bonds become callable.

We go a step further in our identification by examining the same set of regressions as Table 8 on two subsamples. The first subsample isolates observations falling within the narrow band (defined as year –3 to year +3) around the first call date, while the second subsample isolates observations where bonds are particularly important in the debt structure (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. As shown in Table 9, point estimates are slightly higher for the narrower samples than for the wider sample and are statistically significant. Taken together, our results show that callable bonds facilitate takeovers. They imply that wealth transfers from acquirer shareholders to target bondholders are much less of a concern when debt is callable.

[TABLE 9 ABOUT HERE]

Our identification strategy uses the protection period that is standard in length and predetermined at issuance, contrasting 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 call dates on their bonds with future merger opportunities (several years in advance). This is likely far-fetched, since call dates are determined at bond issuance and mechanically set as a standard fraction of bond life. We still explore two additional identification strategies to get around this concern. First, we use bonds with make-whole provisions as a "placebo" and verify if our evidence disappears in data of bonds bearing calls that *do not preclude* debt overhang. We present the results in Section 5.2.3. The second way to get around the concern is to look at shocks to the amount of merger opportunities in an industry. In Section 5.2.4, we present evidence using a regulatory instrument.

5.2.3 Tests using make-whole bonds

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, customarily 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 2018 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, in contrast to fixed-price callable bonds, make-whole bonds are *not likely* to impact debt overhang.

We first compare secondary market prices of callable bonds and make-whole bonds. As shown in Fig. 6, bonds with make-whole provisions are traded above par far more frequently than callable bonds. For example, while only 2% (1%) of callable bonds trade above 1.075 (1.175 or more) times par, 32% (10%) of make-whole bonds do so. This result verifies the prior that make-whole bonds do not limit the potential upside for bondholders.

Next, we show in the takeover context that make-whole bonds do not limit gains to creditors. Similar to the tests of Section 5.1, we compare target bond returns around acquisition announcements across make-whole and non-callable bonds by estimating the following model:

$$R_{i,k} = \alpha + \beta \times Make\text{-}whole_{i,k} + \gamma \times Controls_{i,k} + \theta_i + \varepsilon_{i,k} \tag{4}$$

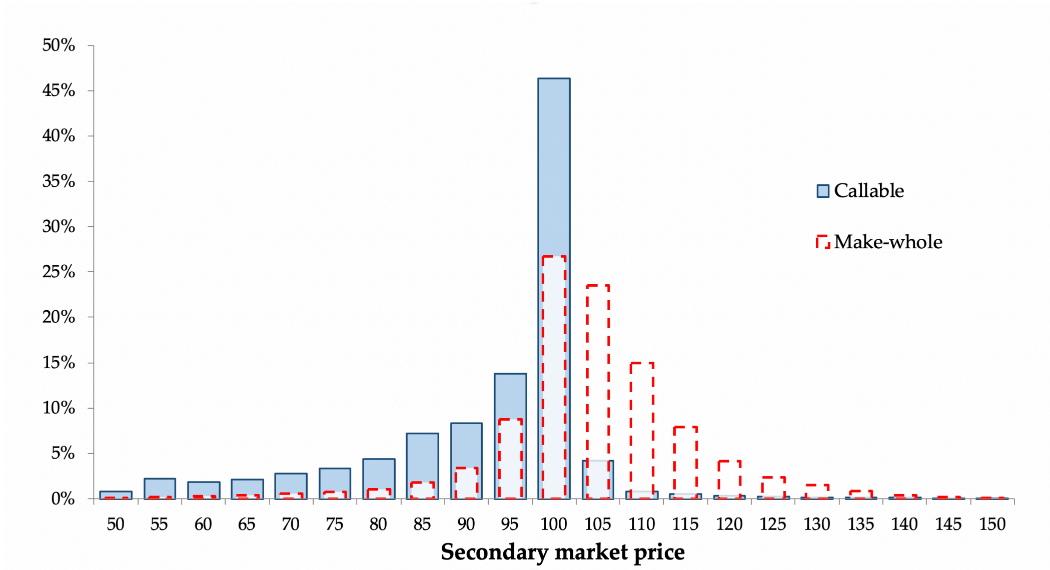

Figure 6. Secondary market prices of callable and make-whole bonds, 2007–2016. This figure presents the histogram of quarter-end prices of corporate bonds constructed from the TRACE database. The column headings indicate interval midpoints in percent of par. In other words, "100" contains all bonds trading 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.

where $R_{i,k}$ is the cumulative return of target firm i's k^{th} bond around the acquisition announcement, and *Make-whole* is a dummy that equals 1 if a bond is make-whole callable, and 0 otherwise. We control for issuer fixed effects and bond characteristics previously described. As shown in Table 10, the announcement returns of make-whole bonds are not different from those of non-callable bonds.

[TABLE 10 ABOUT HERE]

Finally, we repeat the tests on Section 5.2.2 using firms with make-whole bonds as a "placebo treatment group" and compare their probability of becoming acquisition targets with the same "control group" as our base test. The *Make-whole* dummy equals 1 if the firm's bonds are at least 20% make-whole callable in year t, and equals 0 if its bonds are not-yet callable. We use nearest neighborhood matching to select up to 5 control firms within the same industry and year that are closest on multiple firm characteristics. We then estimate the following linear probability takeover model on the newly matched (placebo) firm sample:

$$Target_{i,t} = \alpha + \beta \times Make\text{-}whole_{i,t-1} + \gamma \times Controls_{i,t-1} + \theta_{j,t} + \varepsilon_{i,t} \quad (5)$$

where i, j, and t denote a firm, its industry, and the year of observation, respectively. We also control for interacted industry $\times$ year fixed effects and the same set of firm characteristics at the time of matching as in Section 5.2.2. The results are presented in Table 11.

[TABLE 11 ABOUT HERE]

Column 1 of Table 11 shows that firms in this placebo group (firms whose bonds are make-whole callable) do not have a different probability of becoming acquisition targets, compared to matched firms in the control group (not-yet callables). The coefficient is small in magnitude and statistically insignificant. We also find consistent results when estimating a Cox proportional hazard model (column 2) and when examining firms whose entire stock of outstanding bonds are make-whole callable (columns 3 and 4). These falsification tests confirm that the overhang-prone nature of callable bonds reduces the likelihood of mergers.

5.2.4 Evidence from deregulation

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, price, and other elements of the industries' competitive environment. Ample evidence shows that these actions have led to spikes in the M&A activity in the industries affected (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 industries that witness significant deregulation.

We explore a set of industries observing transformative deregulation events.[13] We consider

[13]Prior studies use the deregulation list in Viscusi et al. (2005). The list was recently updated in Viscusi et al. (2018) to reflect events that occurred from 2002 to 2018. The list is presented in Table A.3.

the first deregulation shock and firms' share of the callable bond prior to the shock. Since the timing and consequences of deregulation are hard to anticipate, it is difficult to argue that firms issue callable bonds several years in advance to facilitate or shape subsequent acquisitions.

We estimate the following takeover probability model over a sample of firms in industries that observe regulatory events that allow for increases in merger events (post-deregulation):

$$Target_{i,post} = \alpha + \beta \times Callable_{i,pre} + \gamma \times Controls_{i,pre} + \theta_j + \varepsilon_i \tag{6}$$

where i and j denote a firm and its industry. The dependent variable, *Target*, is a dummy that takes the value of 1 if 100% of the firm's shares were acquired by another firm in the year following the deregulation event, and 0 otherwise. The 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. Firm control variables are all measured in the year prior to the deregulation.

[TABLE 12 ABOUT HERE]

As shown in column 1 of Table 12, firms with more callable bonds prior to deregulation events have a significantly higher probability of being targeted in the post-deregulation window. We subsequently check the robustness of this finding under various test settings. In column 2, we change the post-deregulation window from 1 year to 3 years and use a Cox model. In column 3, we change the threshold of *Callable* to 50%. In column 4, we use 3 years to define the post-deregulation window and 50% to define the *Callable* group. Estimates from these various tests are fully consistent with the baseline results in column 1.

In all, our estimations show that firms carrying large amounts of callable debt prior to deregulation have a higher probability of being taken as targets after deregulation, pointing to lower debt overhang problems in firms with callable bonds.

6 Capital investment

While the takeover market is a natural setting in which to tests the real effects of debt callability, our theory applies to capital investment as well. In this section, we relate investment spending to investment opportunities to uncover the role of callable bonds in reducing debt overhang. We do so focusing on 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 whether firms with callable bonds invest more when experiencing favorable investment opportunities.

We identify investment opportunity shocks using annual intermediate input price changes. Intermediate inputs represent goods and services that are used in firm production, such as intermediate energy, materials, purchased service input, and labor compensation. A commonly used assumption is that a decline in those costs make investment more profitable (see Campello 2003 and Dasgupta et al. 2018). We define high (low) investment opportunity, $HighOpp$ ($LowOpp$), as a dummy that equals 1 if the percentage change in input prices of the observation is among the sample bottom (top) tercile, and 0 otherwise.

We again utilize the call protection period for testing. The identifying assumption is that the timing of the call protection period is unrelated to the sensitivity of investment to investment opportunities. We consider the *Callable* group to be those firm-year observations where bonds outstanding passed the first call date. We use nearest neighborhood matching to select up to five control firms within the same industry and year that are closest in Book assets, 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 the estimate the following regression:

$$
\begin{aligned}
I_{i,t} = \alpha &+ \beta_1 \times HighOpp_{i,t-1} \times Callable_{i,t-1} + \beta_2 \times LowOpp_{i,t-1} \times Callable_{i,t-1} \\
&+ \beta_3 \times Callable_{i,t-1} + \gamma \times Controls_{i,t-1} + \theta_{j,t} + \varepsilon_{i,t}
\end{aligned}
\tag{7}
$$

where i, j, and t denote a firm, its industry, and the year of observation. We control for industry $\times$ year effects and a number of firm characteristics 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. The results are presented in Table 13.

[TABLE 13 ABOUT HERE]

Our estimations return a positive coefficient to the high investment opportunity $\times$ callable debt interaction term (see column 1 of Table 13). This 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 significant: when at least 20% of bonds become callable, firms are able to scale up investment by an additional 1.8 percentage points, which accounts for 20 percent of the average investment. We then consider the second *Callable* group consisting of firm-year observations where all outstanding bonds become callable. Estimates in column 2 of Table 13 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.[14]

To further eliminate differences in unobserved characteristics between the treated and control groups, we example a subsample of observations falling in the narrow band (from year –3 to year +3) around the first call date. As shown in columns 3 and 4 of Table 13, our results are robust. We also examine a subsample of firms whose bonds exceed 50% of total debt to isolate observations where the bond debt is particularly more important in the debt structure. We again find consistent evidence that firms with more callable bonds invest more when facing favorable investment opportunities (columns 5 and 6 of Table 13). The estimated magnitude is higher than for the baseline sample.

In all, our results offer consistent support to 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.

[14]See Table A.4 for a number of additional robustness checks confirming these findings.

7 Concluding remarks

We document several novel facts about call rights in the context of U.S. corporate bonds issued in the last decades. Callable bonds have higher yields at issue, but they rarely trade above par in the secondary market, with a "missing mass" in the price distribution. Issuers are more likely to call their bonds after issuer-specific credit improvements. This suggests that call rights are best understood through a broad view which we refer to as the "credit view." One implication of the credit view is that callable rights may reduce agency costs of debt, as predicted by Diamond and He (2014). We test the implications of the broad credit view 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 reduce the merger gains that flow to target 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 gains 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. Critically, these benefits 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. In an environment permeated with concerns about unprecedented corporate leverage-taking — including the effect of debt overhang on corporate investment post-Covid-19 (FSB 2022) — the fact that a widespread contractual feature appears to significantly reduce debt overhang is promising.

References

Almeida, H., Campello, M., and Hackbarth, D. (2011). Liquidity Mergers. *Journal of Financial Economics*, 102(3):526–558.

Andrade, G., Mitchell, M., and Stafford, E. (2001). New Evidence and Perspectives on Mergers. *Journal of Economic Perspectives*, 15(2):103–120.

Asker, J. and Ljungqvist, A. (2010). Competition and the Structure of Vertical Relationships in Capital Markets. *Journal of Political Economy*, 118(3):599–647.

Banko, J. C. and Zhou, L. (2010). Callable bonds revisited. *Financial Management*, 39(2):613–641.

Billett, M. T., King, T. H. D., and Mauer, D. C. (2004). Bondholder Wealth Effects in Mergers and Acquisitions: New Evidence from the 1980s and 1990s. *The Journal of Finance*, 59(1):107–135.

Brown, S. and Powers, E. (2020). The Life Cycle of Make-Whole Call Provisions. *The Journal of Corporate Finance*, 65:101772.

Campello, M. (2003). Capital Structure and Product Markets Interactions: Evidence from Business Cycles. *Journal of Financial Economics*, 68(3):353 – 378.

Campello, M. and Gao, J. (2017). Customer Concentration and Loan Contract Terms. *Journal of Financial Economics*, 123(1):108–136.

Dasgupta, S., Li, E. X. N., and Yan, D. (2018). Inventory Behavior and Financial Constraints: Theory and Evidence. *The Review of Financial Studies*, 32(3):1188–1233.

Diamond, D. W. and He, Z. (2014). A Theory of Debt Maturity: The Long and Short of Debt Overhang. *The Journal of Finance*, 69(2):719–762.

Eckbo, B. E. (2014). Corporate Takeovers and Economic Efficiency. *Annual Review of Financial Economics*, 6(1):51 – 74.

Elsaify, A. and Roussanov, N. (2018). Why do Firms Issue Callable Bonds? Working Paper.

FSB (2022). Approaches to Debt Overhang Issues of Non-financial Corporates. *Financial Stability Board Discussion Paper*.

Green, D. (2018). Corporate Refinancing, Covenants, and the Agency Cost of Debt. Working Paper.

Julio, B. (2013). Corporate Investment and the Option to Repurchase Debt. Working Paper.

Kedia, S. and Zhou, X. (2014). Informed Trading Around Acquisitions: Evidence from Corporate Bonds. *Journal of Financial Markets*, 18:182 – 205.

King, T.-H. D. and Mauer, D. C. (2000). Corporate call policy for nonconvertible bonds. *The Journal of Business*, 73(3):403–444.

Mao, L. and Tserlukevich, Y. (2015). Repurchasing Debt. *Management Science*, 61(7):1648 – 1662.

Mayers, D. (1998). Why Firms Issue Convertible Bonds: The Matching of Financial and Real Investment Options. *Journal of Financial Economics*, 47(1):83–102.

Myers, S. C. (1977). Determinants of Corporate Borrowing. *Journal of Financial Economics*, 5(2):147 – 175.

Ovtchinnikov, A. V. (2013). Merger Waves Following Industry Deregulation. *Journal of Corporate Finance*, 21(C):51 – 76.

Powers, E. (2021). The Optimality of Call Provision Terms. *Management Science*, 67(10):5969–6627.

Tewari, M., Byrd, A., and Ramanlal, P. (2015). Callable bonds, reinvestment risk, and credit rating improvements: Role of the call premium. *Journal of Financial Economics*, 115(2):349–360.

Viscusi, K., Harrington, J., and Vernon, J. (2005). *Economics of Regulation and Antitrust.* MA: MIT Press, Cambridge.

Viscusi, K., Harrington, J., and Vernon, J. (2018). *Economics of Regulation and Antitrust.* MA: MIT Press, Cambridge.

Xu, Q. (2018). Kicking Maturity Down the Road: Early Refinancing and Maturity Management in the Corporate Bond Market. *The Review of Financial Studies*, 31(8):3061–3097.

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

	Number of bonds	Mean	Std. dev.	25^{th} perc.	Median	75^{th} perc.
Age (years)	11,111	5.5	3.2	3.3	5.0	7.0
Remaining life (years)	11,010	7.4	8.5	2.2	4.0	8.3
Share of life	11,010	51%	24%	33%	50%	70%

Panel C. Bond features in bond panel data set

	Number of Observations	Mean	Std. dev.	25^{th} perc.	Median	75^{th} perc.
Bond size (log $)	306,468	11.6	1.8	10.8	11.9	12.7
Remaining years	300,347	11.7	10.2	4	8	19
Age (years)	306,553	6.5	7.1	2	4	9
Issuer book leverage	140,798	0.4	0.2	0.3	0.4	0.6
Issuer debt/EBITDA	136,785	4.0	4.5	2.1	3.0	4.5
Issuer upgrade	981,92	0.1	0.3	0	0	0

Table 2. Selected summary statistics: firms

The sample consists of firms in Compustat with non-missing total assets, matched to Mergent FISD (non-financial corporate) bond features and SDC merger data. The observations in this panel data set are firm-years. Callable bonds refer to bonds with fixed-price call features and have passed the protection period. Not-yet callable bonds refer to bonds with call features but are not yet at the first call date. Total assets are deflated to 2015 MUSD.

Panel A. Full sample

	Obs.	Mean	Std. dev	25^{th} perc.	75^{th} perc.
Callable bond debt/Total debt	322,694	0.010	0.082	0	0
Not-yet callable bond debt/Total debt	322,694	0.022	0.148	0	0
Non-callable bond debt/Total debt	322,694	0.027	0.136	0	0
Leverage (Book)	322,036	0.297	0.391	0.038	0.404
Cash flow	270,950	–0.04§	0.505	–0.032	0.131
Tobin's q	257,949	2.740	4.256	1.028	2.542
Total assets (log)	322,694	0.592	2.801	–1.248	2.470
Age (since IPO)	322,694	11.807	12.011	4	17
Investment	322,694	0.137	0.208	0.005	0.155
Target	302,243	2.88%	16.71%	0	0

Panel B. Firms with positive callable bond debt

		Mean	Std. dev	25^{th} perc.	75^{th} perc.
Callable bond debt/Total debt	8,911	0.353	0.352	0.064	0.602
Not yet callable bond debt/Total debt	8,911	0.281	0.343	0	0.509
Non-callable bond debt/Total debt	8,911	0.166	0.284	0	0.227
Leverage (Book)	8,911	0.435	0.272	0.287	0.513
Cash Flow	8,566	0.080	0.088	0.044	0.114
Tobin's q	6,476	1.613	1.422	1.058	1.750
Total assets (log)	8,911	3.406	1.575	2.368	4.445
Age (since IPO)	8,911	27.98	16.02	14	41
Investment	8,911	0.081	0.077	0.035	0.102
Target	8,088	3.02%	17.10%	0	0

Panel C. Firms with zero callable and not yet callable bond debt

		Mean	Std. dev	25^{th} perc.	75^{th} perc.
Non-callable bond debt/Total debt	298,068	0.019	0.120	0	0
Leverage (Book)	297,410	0.286	0.398	0.028	0.387
Cash Flow	247,643	–0.053	0.525	–0.044	0.132
Tobin's q	239,335	2.829	4.387	1.026	2.648
Total assets (log)	298,068	0.375	2.772	–1.418	2.158
Age (since IPO)	298,068	11.911	11.210	4	16
Investment	298,068	0.140	0.255	0.003	0.159
Target	280,360	2.85%	16.65%	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. We control for bond characteristics at issue such as bond size, maturity, covenant, and seniority. 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. Seniority is an indicator for bonds with a security level of "senior secured", "senior subordinate" or "senior" 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 (%):	6.018	6.018	6.191
	(1)	(2)	(3)
Fixed-price callable	**0.267***** (0.056)	-	-
Fixed-price callable (IG)	-	**0.160**** (0.077)	**0.172***** (0.054)
Fixed-price callable (HY)	-	**0.381***** (0.093)	**0.382***** (0.093)
Make-whole callable	**0.152*** (0.087)	**0.156*** (0.086)	**0.136*** (0.070)
Other bond characteristics	Yes	Yes	Yes
Year-month X Maturity F.E.	No	Yes	Yes
Year-month X IG F.E.	Yes	Yes	Yes
Year-month X Duration F.E.	Yes	Yes	Yes
Year-month X issuer F.E.	Yes	Yes	No
Year X issuer F.E.	No	No	Yes
Clusters	Issuer, time	Issuer, time	Issuer, time
R-squared	0.914	0.914	0.891
Observations	20,187	20,187	20,187

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. Change variables and the upgrade variable represent changes from t-2 to t-1. We control for bond characteristics such as bond size (log), bond age, remaining life, duration, covenant, and seniority. 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 (%):	8.69	9.60	20.85
	(1)	(2)	(3)
Ratings change	**1.052***** (0.228)	-	-
Leverage dropped	-	**9.236***** (2.305)	-
Change in bond price	-	-	**0.297***** (0.071)
Other bond characteristics	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes
Clusters	Issuer	Issuer	Issuer
R-squared	0.074	0.093	0.043
Observations	32,426	6,702	5,865

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 cumulative bond return of the target firm around acquisition announcements. The event window in columns 1 and 2 is from days -1 to $+5$ where day zero is the date of announcement, and in columns 3 and 4 is from days -5 to $+15$. Returns are calculated with data from TRACE. *Callable* is a dummy that equals to 1 for bonds that are fixed-price callable at the time of the M&A announcement, and 0 otherwise. *Not-yet Callable* is a dummy that equals to 1 for bonds that have callable features but have not passed their protection periods at the time of the M&A announcement, and 0 otherwise. The sample consists of bonds of target firms which have 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 and control for bond characteristics such as bond size (log), remaining time to maturity, and bid-ask spreads. In columns 2 and 4, we exclude bonds that have less than one year to maturity and 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:	Bond announcement return			
Dep. Var. Mean (%):	0.016	0.016	0.025	0.025
	(1)	(2)	(3)	(4)
Callable	**–0.032****	**–0.034****	**–0.047*****	**–0.050*****
	(0.015)	(0.017)	(0.015)	(0.017)
Not-yet Callable	–0.024	–0.024	–0.025	–0.024
	(0.019)	(0.020)	(0.017)	(0.017)
Other bond characteristics	Yes	Yes	Yes	Yes
Issuer F.E.	Yes	Yes	Yes	Yes
Event window	[-1,$+5$]	[-1,$+5$]	[-5,$+15$]	[-5,$+15$]
Sample restrictions				
Time to maturity $>= 1$	No	Yes	No	Yes
Pre-event trades $>= 5$	No	Yes	No	Yes
R-squared	0.531	0.548	0.592	0.610
Observations	449	419	449	419

Table 6. Takeover probability and callable bond debt

This table presents panel models examining whether firms' probability of being takeover targets increases with their callable bond debt. The initial sample consists of Compustat firms. We obtain from SDC deals involving public targets and define successful deals as those where the acquirer did not own shares prior to the bid and acquired 100% of the target through the bid. For each issuer-year, *Callable Bond Debt* is computed as the value of callable bonds outstanding, divided by the value of total debt. Correspondingly, *Not-yet Callable Bond Debt* and *Non-callable Bond Debt* are computed as the value of not-yet callable bonds and non-callable bonds outstanding, both divided by the value of total debt. Each column contains a linear probability (OLS) or a proportional hazard model (Cox) of firms being successfully targeted in the subsequent year, all control for (Fama-French 12) industry-year fixed effects. In columns 2 and 4, we further control for firm characteristics including Leverage, Book assets (log), q, and Age (log), 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 issuer 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 (%):	0.035	0.035	0.035	0.035
Model	OLS	OLS	Cox	Cox
	(1)	(2)	(3)	(4)
Callable Bond Debt	**0.025*** **	**0.019** **	**1.727*** **	**1.446** **
	(0.008)	(0.008)	(0.235)	(0.219)
Not-yet Callable Bond Debt	0.015***	0.005	1.407***	1.092
	(0.004)	(0.006)	(0.125)	(0.140)
Non-callable Bond Debt	–0.001	–0.001	0.967	0.980
	(0.004)	(0.005)	(0.099)	(0.139)
Other characteristics	No	Yes	No	Yes
Industry X Year F.E.	Yes	Yes	Yes	Yes
# of unique firms	5,293	3,007	5,293	3,007
Observations	32,286	18,653	32,286	18,653

Table 7. 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 at least 20% (or 100%) of bonds outstanding have passed the first call date. The "Not-yet" group includes firm-years in which bonds are not yet at the first call date. We require each Fama-French 12 industry-year to have at least one "callable" firm and one "Not-yet" firm. 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

Treated group	**Callable share** $> 20\%$				**Callable share** $= 100\%$			
	Callable	Not-yet	Difference	t-stats	Callable	Not-yet	Difference	t-stats
	(1)	(2)	(1) – (2)		(3)	(4)	(3) – (4)	
Total assets (log)	3.336	3.567	–0.231	(–0.327)	2.671	3.528	–0.857	(–0.910)
Leverage (Book)	0.420	0.401	0.019	(0.181)	0.435	0.403	0.032	(0.246)
Tobin's q	1.722	1.679	0.044	(0.086)	1.783	1.710	0.073	(0.102)
Age (since IPO, log)	2.501	2.319	0.182	(0.607)	2.454	2.370	0.084	(0.171)
Callable (or not-yet) share	0.860	0.786	0.073	(0.545)	1.000	0.791	0.209	(1.050)
HY issuer rating	0.627	0.589	0.038	(0.188)	0.812	0.671	0.141	(0.542)

Panel B. Post-matching difference in characteristics

Treated group	**Callable share** $> 20\%$				**Callable share** $= 100\%$			
	Callable	Not-yet	Difference	t-stats	Callable	Not-yet	Difference	t-stats
	(1)	(2)	(1) – (2)		(3)	(4)	(3) – (4)	
Total assets (log)	3.367	3.531	–0.164	(–0.510)	2.672	3.103	–0.431	(–1.067)
Leverage (Book)	0.403	0.393	0.010	(0.221)	0.435	0.415	0.020	(0.322)
Tobin's q	1.620	1.604	0.015	(0.085)	1.777	1.740	0.037	(0.143)
Age (since IPO, log)	2.498	2.399	0.098	(0.793)	2.454	2.378	0.076	(0.368)
Callable (or not-yet) share	0.858	0.817	0.041	(0.732)	1.000	0.909	0.091	(1.517)
HY issuer rating	0.626	0.598	0.028	(0.350)	0.811	0.764	0.047	(0.671)

Table 8. 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 the issuers' 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 if their bonds remain not yet callable. Each issuers in the callable group is matched to five 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	Callable share $> 20\%$	Callable share $> 20\%$	Callable share $= 100\%$	Callable share $= 100\%$
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 9. Takeover probability: subsamples

This table presents regressions of takeover probabilities as in Table 8. In Panel A, the tests are implemented for a subsample of firms falling within the narrow band (from year –3 to year +3) around the first call date. In Panel B, the tests are performed for a subsample of firms whose bond debt exceeds 50% of total debt. All variables are defined as in Table 8. 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).

Panel A. Firms falling within the narrow band around the first call date

Dependent variable:	Target			
Dep. Var. Mean (%):	0.027	0.027	0.023	0.023
Model	OLS	Cox	OLS	Cox
	(1)	(2)	(3)	(4)
Callable	**0.020*** **	**1.758*** **	**0.026*** **	**2.104*** **
	(0.005)	(0.233)	(0.009)	(0.432)
Other characteristics	Yes	Yes	Yes	Yes
Matching				
Treatment	Callable share $> 20\%$	Callable share $> 20\%$	Callable share $= 100\%$	Callable share $= 100\%$
Control	Not-yet	Not-yet	Not-yet	Not-yet
Industry X Year F.E.	Yes	Yes	Yes	Yes
# of unique firms	1,368	1,368	966	966
Observations	14,735	14,735	6,401	6,401

Panel B. Firms whose bond debt exceeds 50% of total debt

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	Callable share $> 20\%$	Callable share $> 20\%$	Callable share $= 100\%$	Callable share $= 100\%$
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 10. Placebo tests: Make-whole bond returns around merger announcements

This table presents regressions of bond announcement returns around M&A announcements, using make-whole bonds as the placebo group. The dependent variable is defined as cumulative bond return of the target firm around acquisition announcements. The event window in columns 1 and 2 is from days -1 to $+5$ where day zero is the date of announcement, and in columns 3 and 4 is from day -5 to $+15$. Returns are calculated with data from TRACE. *Make-whole* is a dummy that equals to 1 for bonds that are make-whole callable at the time of the M&A announcement, and 0 for non-callable bonds. 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 and control for bond characteristics such as bond size (log), remaining time to maturity, and bid-ask spreads. In columns 2 and 4, we exclude bonds that have less than one year to maturity and 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:	Bond announcement return			
Dep. Var. Mean (%):	0.016	0.016	0.025	0.025
	(1)	(2)	(3)	(4)
Make-whole	**0.001**	**0.003**	**0.008**	**0.011**
	(0.010)	(0.010)	(0.010)	(0.010)
Other bond characteristics	Yes	Yes	Yes	Yes
Issuer F.E.	Yes	Yes	Yes	Yes
Event window	[-1,+5]	[-1,+5]	[-5,+15]	[-5,+15]
Sample restrictions				
Time to maturity $>= 1$	No	Yes	No	Yes
Pre-event trades $>= 5$	No	Yes	No	Yes
R-squared	0.588	0.536	0.634	0.622
Observations	346	322	346	322

Table 11. Placebo tests: 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. Each issuer in the Make-whole group is matched to five 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).

Dependent variable:	Target			
Dep. Var. Mean (%):	0.042	0.042	0.039	0.039
Model	OLS	Cox	OLS	Cox
	(1)	(2)	(3)	(4)
Make-whole	**0.005**	**1.141**	**0.001**	**1.006**
	(0.005)	(0.130)	(0.006)	(0.146)
Controls	Yes	Yes	Yes	Yes
Matching				
Placebo Treatment	MW share $> 20\%$	MW share $> 20\%$	MW share $= 100\%$	MW share $= 100\%$
Control	Not-yet	Not-yet	Not-yet	Not-yet
Industry X Year F.E.	Yes	Yes	Yes	Yes
# of unique firms	1,775	1,775	1,492	1,492
Observations	23,636	23,636	17,106	17,106

Table 12. Takeover probability around deregulation events

This table reports regressions of takeovers probability around deregulations. The sample includes firms from 4-digit SIC industries that were deregulated between 1980 and 1999. 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 bond 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	OLS	OLS	OLS
	(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 share $> 20\%$	Callable share $> 20\%$	Callable share $> 50\%$	Callable share $> 50\%$
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 13. Investment: matched samples around the first call date

This table presents the results on investment using matched samples. The initial sample (columns 1 and 2) consists of Compustat firms with high-yield issuer ratings that have issued callable bonds. In columns 3 and 4, the sample is restricted to firms falling within the narrow band (from year –3 to year +3) around the first call date, and in columns 5 and 6, firms whose bond debt exceeds 50% of total debt. For each firm-year observation, Callable is a dummy that equals 1 if the issuers' bonds become callable – either the callable share of bonds outstanding increases from 0 to at least 20% (columns 1, 3, and 5) or to 100% (columns 2, 4, and 6), and 0 if their bonds remain not yet callable. Each issuer in the callable group is matched to five 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.

Sample	All HY		Narrow band		$Bond/Debt \geq 50\%$	
Dependent variable:	Investment		Investment		Investment	
Dep. Var. Mean (%):	0.092	0.081	0.092	0.082	0.095	0.079
	(1)	(2)	(3)	(4)	(5)	(6)
HighOpp X Callable	**0.018****	**0.036****	**0.021****	**0.037****	**0.023****	**0.039****
	(0.009)	(0.014)	(0.007)	(0.014)	(0.011)	(0.017)
LowOpp X Callable	0.004	0.002	0.007	0.003	–0.001	0.000
	(0.009)	(0.011)	(0.009)	(0.012)	(0.011)	(0.012)
Callable	–0.017***	–0.009	–0.011	–0.011	–0.005	–0.005
	(0.006)	(0.009)	(0.007)	(0.010)	(0.008)	(0.011)
Other characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Matching						
Treatment	Callable share $> 20\%$	Callable share $= 100\%$	Callable share $> 20\%$	Callable share $= 100\%$	Callable share $> 20\%$	Callable share $= 100\%$
Control	Not-yet	Not-yet	Not-yet	Not-yet	Not-yet	Not-yet
Industry X Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
# of unique firms	902	595	768	538	693	452
Observations	6,174	2,476	5,131	2,238	4,447	1,761

Appendix A Additional tables

Table A.1. Robustness tests on takeover probabilities using various cutoffs

This table presents robustness tests on takeover probabilities for Table 8, using different cutoffs to categorize the callable group. 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 the issuers' bonds have passed the first call date – the callable share of bonds outstanding is at least 40% (columns 1 and 2) or 60% (columns 3 and 4) or 80% (columns 5 and 6), and 0 if their bonds remain not yet callable. The callable group 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 (%):	0.032	0.032	0.032	0.032	0.035	0.035
Model	OLS	Cox	OLS	Cox	OLS	Cox
	(1)	(2)	(3)	(4)	(5)	(6)
Callable	**0.013*** **	**1.388*** **	**0.015** **	**1.437*** **	**0.019*** **	**1.532*** **
	(0.005)	(0.165)	(0.007)	(0.202)	(0.008)	(0.231)
Other characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Matching						
Treatment	Call. share $> 40\%$	Call. share $> 40\%$	Call. share $> 60\%$	Call. share $> 60\%$	Call. share $> 80\%$	Call. share $> 80\%$
Control	Not-yet	Not-yet	Not-yet	Not-yet	Not-yet	Not-yet
Industry X Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
# of unique firms	1,638	1,638	1,439	1,439	1,327	1,327
Observations	20,513	20,513	14,461	14,461	11,580	11,580

Table A.2. Robustness tests on takeover probabilities for the subsamples

This table presents robustness tests for the subsamples as examined in Table 9. In Panel A, the subsample includes firms falling in the narrow band (from year –3 to year + 3) around the first call date. In Pane B, the subsample includes firms whose bond debt exceeds 50% of total debt. All variables are defined as in Table A.1. 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).

Panel A. Firms falling within the narrow band around the first call date

Dependent variable:	Target					
Dep. Var. Mean (%):	0.025	0.025	0.025	0.025	0.023	0.023
Model	OLS	Cox	OLS	Cox	OLS	Cox
	(1)	(2)	(3)	(4)	(5)	(6)
Callable	**0.019*** **	**1.763*** **	**0.022*** **	**1.814*** **	**0.027*** **	**2.165*** **
	(0.006)	(0.280)	(0.008)	(0.333)	(0.009)	(0.433)
Other characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Matching						
Treatment	Call. share $> 40\%$	Call. share $> 40\%$	Call. share $> 60\%$	Call. share $> 60\%$	Call. share $> 80\%$	Call. share $> 80\%$
Control	Not-yet	Not-yet	Not-yet	Not-yet	Not-yet	Not-yet
Industry X Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
# of unique firms	1,206	1,206	1,069	1,069	989	989
Observations	11,068	11,068	8,026	8,026	6,628	6,628

Panel B. Firms whose bond debt exceeds 50% of total debt

Dependent variable:	Target					
Dep. Var. Mean (%):	0.033	0.033	0.034	0.034	0.034	0.034
Model	OLS	Cox	OLS	Cox	OLS	Cox
	(1)	(2)	(3)	(4)	(5)	(6)
Callable	**0.022*** **	**1.690*** **	**0.025*** **	**1.775*** **	**0.032*** **	**1.982*** **
	(0.007)	(0.241)	(0.009)	(0.307)	(0.012)	(0.422)
Other characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Matching						
Treatment	Call. share $> 40\%$	Call. share $> 40\%$	Call. share $> 60\%$	Call. share $> 60\%$	Call. share $> 80\%$	Call. share $> 80\%$
Control	Not-yet	Not-yet	Not-yet	Not-yet	Not-yet	Not-yet
Industry X Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
# of unique firms	1,041	1,041	879	879	789	789
Observations	11,232	11,232	7,724	7,724	5,967	5,967

Table A.3. Deregulation events

This table lists major federal deregulation events affecting entry, and other elements of the industries' competitive environment. The main source is Viscusi et al. (2005) and Viscusi et al. (2018). Four-digit SIC codes affected are taken from Asker and Ljungqvist (2010). We exclude deregulation events affecting the financial sector.

Year	Deregulatory initiatives	Description	Four-digit SIC codes affected
1980	Motor Carrier Reform Act	Partial deregulation of trucking	4131, 4142, 4212, 4213
	Household Goods Transportation Act	Applies deregulatory measures in Motor Carrier Reform Act to household moving services	4212, 4214
	Staggers Rail Act	Deregulation of railroads	4011, 4013, 4741, 4789
	International Air Transportation Competition Act	Second stage of deregulation of airlines (gradually implemented between 1978 and 1982)	4512, 4522
	Deregulation of cable television (FCC)	Precursor to 1984 Cable Television Deregulation Act	4841
	Deregulation of customer premises equipment and enhanced services (FCC)	Precursor to 1984 Cable Television Deregulation Act	4841, 4899
1981	Decontrol of crude oil and refined petroleum products (executive order)	Oil price controls lifted by Reagan administration	1311, 1381, 2911, 2992, 2865, 2869, 4612, 5171, 5172, 5411
	Deregulation of radio (FCC)	Lifts requirement that radio stations have to provide news content; lowers costs and facilitates entry and diversity of service	4832
1982	Bus Regulatory Reform Act	Partial deregulation of bus and trucking industries entry and exit of bus services facilitated and pricing controls eased; transborder trucking deregulated	4111, 4142, 4151
	AT&T settlement (breakup of AT&T)	AT&T forced to split, divesting the local exchange service providers; an earlier consent decree (1956) restricting AT&T's scope of business is lifted	3661, 4812, 4813, 4822, 4899

(*continued*)

Year	Deregulatory initiatives	Description	Four-digit SIC codes affected
1984	Cable Television Deregulation Act	Bars regulation in communities where there is "effective competition," defined by the FCC to be more than three broadcast stations	4841
	Shipping Act	Deregulates ocean shipping	4412, 4491
1986	Trading of Airport Landing Rights	Allows trading of airport landing rights	4512, 4522, 4581
1989	Natural Gas Wellhead Decontrol Act of 1989	Removes price controls on natural gas	1311, 4922, 4925
1992	Cable Television Consumer Protection and Competition Act	Changes to the regulation of cable TV	4841
	Energy Policy Act	Opens up wholesale competition by giving FERC the authority to order vertically integrated utilities to act as a common carrier of electrical power	4911
	FERC Order 636	Requires pipeline operators to unbundle the sale and transportation of natural gas	4922, 4924 4925
	Negotiated Rates Act	Eliminates regulatory distortions related to trucking rates	4212, 4213, 4214
1994	Trucking Industry and Regulatory Reform Act	Eliminates remaining interstate and intrastate trucking regulations	4212, 4213, 4214
1996	Telecommunications Act	Deregulates cable TV rates, sets conditions for local telephone companies to enter long-distance telephone markets, and mandates equal access to local telephone systems	4841
	FERC Order 888	Removes impediments to competition in the wholesale bulk power market	4911
1999	FERC Order 2000	Advocated establishment of independent regional transmission organizations to facilitate competition in wholesale electricity markets	4911

Table A.4. Robustness tests on investment using various cutoffs

This table presents robustness tests on investment for Table 13, using different cutoffs to categorize the callable group. The initial sample (in Panel A) consists of Compustat firms with high-yield issuer ratings that have issued callable bonds. In Panel B, the sample is restricted to firms falling within the narrow band (from year –3 to year +3) around the first call date, and in Panel C, firms whose bond debt exceeds 50% of total debt. For each firm-year observation, *Callable* is a dummy that equals 1 if the issuers' bonds become callable – either the callable share of bonds outstanding increases from 0 to at least 40% (column 1) or 60% (column 2) or 80% (column 3), and 0 if their bonds remain not yet callable. The callable group 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.

Panel A. All HY firms

Dependent variable:	Investment		
Dep. Var. Mean (%):	0.084	0.083	0.081
	(1)	(2)	(3)
HighOpp X Callable	**0.035*** **	**0.039*** **	**0.039*** **
	(0.011)	(0.013)	(0.014)
LowOpp X Callable	**0.012**	**0.012**	**0.002**
	(0.009)	(0.011)	(0.011)
Callable	–0.019***	–0.016**	–0.010
	(0.007)	(0.009)	(0.009)
Other characteristics	Yes	Yes	Yes
Matching			
Treatment	Callable share $> 40\%$	Callable share $> 60\%$	Callable share $> 80\%$
Control	Not-yet	Not-yet	Not-yet
Industry X Year F.E.	Yes	Yes	Yes
# of unique firms	766	637	597
Observations	4,264	3,059	2,511

Panel B. Firms falling within the narrow band around the first call date

Dependent variable:	Investment		
Dep. Var. Mean (%):	0.084	0.083	0.081
	(1)	(2)	(3)
HighOpp X Callable	**0.036*** **	**0.040*** **	**0.040** **
	(0.012)	(0.013)	(0.015)
LowOpp X Callable	**0.014**	**0.014**	**0.002**
	(0.010)	(0.011)	(0.011)
Callable	–0.019*	–0.022***	–0.012
	(0.008)	(0.008)	(0.010)
Other characteristics	Yes	Yes	Yes
Matching			
Treatment	Callable share $> 40\%$	Callable share $> 60\%$	Callable share $> 80\%$
Control	Not-yet	Not-yet	Not-yet
Industry X Year F.E.	Yes	Yes	Yes
# of unique firms	683	584	541
Observations	3,738	2,779	2,268

Panel C. Firms whose bond debt exceeds 50% of total debt

Dependent variable:	Investment		
Dep. Var. Mean (%):	0.082	0.080	0.078
	(1)	(2)	(3)
HighOpp X Callable	**0.040*** **	**0.040** **	**0.040** **
	(0.014)	(0.016)	(0.017)
LowOpp X Callable	**0.010**	**0.011**	**0.000**
	(0.011)	(0.011)	(0.012)
Callable	–0.017**	–0.012	–0.006
	(0.008)	(0.009)	(0.010)
Other characteristics	Yes	Yes	Yes
Matching			
Treatment	Callable share $> 40\%$	Callable share $> 60\%$	Callable share $> 80\%$
Control	Not-yet	Not-yet	Not-yet
Industry X Year F.E.	Yes	Yes	Yes
# of unique firms	594	497	454
Observations	3,025	2,190	1,787