DISCUSSION PAPER SERIES

DP16239

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FINANCIAL ECONOMICS

CEPR

ISSN 0265-8003

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Discussion Paper DP16239
Published 09 June 2021
Submitted 05 June 2021

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JEL Classification: G32, G33, G21

Keywords: Callable bonds, credit risk, Debt overhang, Investment Decisions

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Acknowledgements
We thank Martin Fridson, Andrew Kalotay, Raj Iyer, Brandon Julio (discussant) as well as seminar participants at the CEF Workshop, CICF, CAIFC, Colorado State University, DePaul, Gothenburg, Groningen, Nanyang Technological University, SAIF, Singapore Management University, Utrecht, the Swedish House of Finance, and IFN for comments and suggestions. Becker and Dong wish to acknowledge financial support from "Jan Wallanders och Tom Hedelius Stiftelse", and from "Tore Browaldhs Stiftelse"

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Bo Becker † Murillo Campello ‡ Viktor Thell § and Dong Yan ¶

June 5, 2021

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Call provisions allow bond issuers to redeem their bonds early. While commonly observed, existing research offers limited insight into the purpose of this contract feature. We show that bond callability is designed to mitigate agency problems, with call features and execution being determined by credit spreads and issuer quality. Callable bonds have significantly higher yields and lower secondary market prices than non-callable bonds ("cost of callability"). Issuers call bonds when their credit quality improves. We provide novel evidence that callability reduces debt overhang affecting decisions ranging from capital investment to takeovers. Our results help explain the prevalence of call features and suggest that callability improves economic efficiency.

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1 Introduction

U.S. companies have relied on callable bonds as they boost their leverage in recent years. From 2000 to 2020, callable bonds grew from 32% to nearly 90% of new bond issues (see top panel of Figure 1). Differences between callable and non-callable bonds are economically important. *Within*-issuer comparisons show that the average yield is 27 basis points *higher* for callable bonds. In what may appear to be paradoxical, secondary market prices of callable bonds are *lower* than prices of non-callable bonds. And the value difference between the two types of bonds is significant: the value of outstanding bonds would rise by $250 billion if call rights were eliminated. This combination of high yields and low prices may not be a paradox if the market compensates bond investors for the option value embedded in callable instruments. Call provisions should be particularly valuable in times of high volatility, and aggregate data show that the issuance of callable bonds have increased sharply during the 2000–1 recession, the 2008–9 Financial Crisis, and the Covid-19 crisis (see bottom panel of Figure 1).

There is limited research on why bond callability is so common and valuable. The conventional description of calls appearing in textbooks and industry accounts stresses that callability bundles an interest rate option with a bond.[1] Simply put, when the Treasury yield curve moves down, firms can call outstanding 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 interest rate risk as the motive for including calls in bond issues, as the "interest view." An alternative, broader view, takes as its starting point that bond yields depend on several factors beyond risk-free rates; chiefly, issuer-specific credit risk and credit spreads. Firms have an incentive to call their outstanding debt when their own credit risk declines or when credit spreads tighten. We refer to this as the "credit view" of calls.

[1] We focus on "fixed-price" calls, where the call price is set at par or some other predetermined level. Bonds can also have a "make-whole" call feature which allows the issuer to call at a price that depends on interest rates (effectively above par). Make-whole calls are rarely exercised. Tewari et al. (2015) document systematic differences in call prices and point out that higher call prices protect investors.

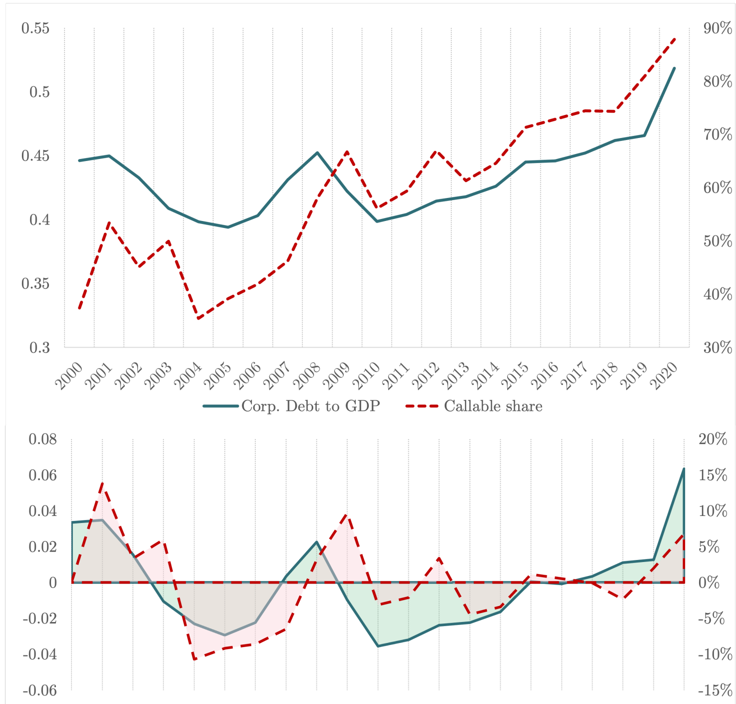

Figure 1: **Callable share and leverage.** This figure shows corporate debt (normalized by GDP) from U.S. Flow of Funds and the callable share of new bond issues from Mergent FISD. Top panel: levels (leverage on left-hand scale); bottom panel: detrended leverage and callable share. Series correlations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

The credit view distinguishes itself for connecting debt call features to agency costs in the firm. It follows from theoretical arguments in Bodie and Taggart (1978), Barnea et al. (1980), and more recently, Diamond and He (2014), who show that callability can improve investment incentives by reducing agency problems associated with debt overhang and information asymmetry. These models suggest that the inclusion of call provisions is linked to issuers' credit risk and growth opportunities, and that investment decisions are shaped by the possibility of calling debt. We add to this line of theories by characterizing a well-defined, critical setting where debt callability interacts with agency costs and real activity. As we discuss below, our argument builds on the insight that in merger deals call provisions in targets' debt can reduce agency problems. We develop the implications of our argument for merger announcement returns and merger activity through a simple model framework.[2]

[2]Other motives for calls include altering restrictive covenants (Green 2018 and King and Mauer 2000),

This paper is primarily empirical: we provide a comprehensive data-based assessment of the credit and interest views of callable bonds. Both views on bond callability offer a rich set of testable predictions that can be differentiated in the data. We first identify testable hypotheses along the life cycle of callable bonds that can discriminate between those alternative views. We subsequently test those relevant hypotheses using information covering decades of life histories of U.S. corporate bonds together with data on secondary market bond prices.

The credit view finds strong support in the data. First, issuers' call decisions are highly predictable by *non-interest* factors. Calls are predicted by positive changes to firm credit quality (e.g., rating upgrades or falling yields on bonds), raising the annual call hazard rate by one third, holding time-series variables (interest rates and spreads) fixed. In other words, observed call decisions reflect identifiable concerns beyond risk-free rates.

Second, post-issuance prices differ dramatically between callable and non-callable bonds. Under the credit view, calls should be triggered by value improvements, including reduced issuer credit risk or a general credit spread compression. Accordingly, the resulting distribution of secondary market prices should have a "missing mass" above the call threshold compared to bonds that cannot be called. This prediction is indeed observed in secondary market prices. For example, a common call price is 3% above par (see Powers 2021). Approximately 35% of non-callable bonds trade above this level, while only 5% of callable bonds do so. On the flip side, the distribution of below-par prices is identical across both non-callable and callable bonds. The implication is that high prices are observationally much rarer for 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.

enabling arbitrage across convertible bonds (Grundy and Verwijmeren 2018), matching durations of assets and liabilities (Elsaify and Roussanov 2018), and managing debt maturity (Xu 2017). These motives are not unique to fixed-price calls and can also apply to make-whole calls, tender offers, and other repurchases.

Third, callable bonds should provide higher yields to bondholders as compensation for lower expected future capital gains. We estimate empirically that yields at issue for callable bonds are 27 bps higher than non-callable bonds from the *same issuer*.[3] This "cost of callability" varies with credit quality: high-yield (HY) callable bonds have around 40 bps higher yield (this corresponds to a 4% value difference for a ten-year bond). These differences in pricing are too large to reflect interest rate options (cf. Gupta and Subrahmanyam 2005), again showing that the broader credit view fits the data better than the narrow interest view.

In the final part of our analysis, we connect callable bond features to firm investment. Critically, investment decisions should differ between firms that have debt with call provisions and those that do not. In particular, callable debt limits the upside value of debt claims, leaving more for shareholders when the market's view of firm credit quality improves. As such, callable debt reduces debt overhang in the sense of Myers (1977). For this reason, theory suggests that call features should increase corporate propensity to take on investment.

We study callable debt-induced investment in the context of mergers and acquisitions. Besides its novelty, one advantage of the acquisition setting is cleaner identification. We start from the observation that while a target's debt structure is relevant for a takeover, it is less subject to common self-selection concerns than the acquirer's own debt structure. In our model, wealth transfers from acquirer shareholders to target bondholders discourage bids (just like wealth transfers discourage greenfield investment in a leveraged firm). The model suggests that callable bond issuers are *more likely* to be targets of takeovers and that their bondholders should gain less from merger transactions. We show that these predictions are borne out in data of bond prices and M&A activity: while non-callable bondholders experience, on average, 3.1% positive returns on takeover announcements, callable bonds do not.[4]

[3]This refers to yield-to-maturities reported by Mergent. Estimations are within issuer-month and feature controls for duration and maturity, among several other parameters. They eliminate concerns related to selection into issuance of callable debt.

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

We also show that callable debt predicts being the target of a successful takeover attempt.

To narrow identification further, we utilize the ex-ante contractually-set period when calls *cannot be exercised* — referred to as the "call protection period" — as a quasi-random assignment.[5] To wit, we compare the likelihood of becoming a target for firms whose callable bonds are still in the protection period (not yet callable) *vis-à-vis* those that are already callable. We find that when as low as 20% of the bonds issued by a company become callable, the hazard rate of becoming an acquisition target increases by 44%, compared to firms with a similar amount of not yet callable debt. Going a step further in identifying the effects of interest, we examine merger activity around government-led deregulatory initiatives (events that trigger large, often unexpected changes in industry consolidation dynamics). In this test setting, we find that firms with more callable debt are far more likely to be targeted in the merger waves that follow deregulation.

To generalize our inferences on bond call features and firm real activity, we consider a test setting focusing on traditional corporate investment (fixed capital expenditures). We compare corporate spending responses 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. The identifying assumption is that ex-ante contracted call features are unrelated to the exact timing and the severity of such shocks. We do so again utilizing the protection period to account for endogeneity concerns. We find that callable debt predicts larger investment responses (by about one fifth of average investment rates) to favorable shocks to input prices. As predicted by the theory, having callable debt raises the elasticity of investment to investment opportunities.

To date, the narrow interest view is commonly used as a reference framework under which

[5]This period is conventionally set to half of maturity at the time of issuance (see Xu 2017), which means that the precise time when it ends is determined years earlier for most callable bonds. This unique feature accounts for the endogeneity concern that firms with callable bonds are different from those without callable bonds in dimensions directly related to takeover probabilities.

to understand bond callability.[6] By adding evidence bearing on this issue, we identify the quantitative weakness of this prevailing narrative, and more importantly, demonstrate how the credit view better explains the pricing of bonds *both* at issue and in secondary markets. Our analysis also shows how the credit view also connects callable bonds to investment incentives and debt overhang. It suggests that this connection is important in practice and may well operate across various types of capital budgeting decisions. Debt callability is shown to be a key capital structure parameter — comparable to maturity and seniority — bearing important implications for observed corporate behavior. Our analysis of how firms manage the callability of their debt carries further implications for macro-level dynamics (aggregate debt overhang in the corporate sector) and the pricing of credit in the private sector.

The rest of the paper is organized as follows. Section 2 describes callable bonds. Section 3 theoretically examines the interplay between debt overhang and callable debt. Section 4 presents empirical results on the real effects of callable bonds. Section 5 concludes.

2 Callable bonds

In this section, we provide new, comprehensive evidence of the prevalence of callable bonds, their pricing, and the call behavior of issuers. We discuss how the data can discriminate between alternative views. We refer to the conventional theory that emphasizes interest rates as the (sole) driver of call decisions and managing interest rate risk as the (unique) motivation for including call features as the "interest view." In contrast, we refer to the broader view that relates bond prices (and yields) to risk-free interest rates, credit risk, as well as credit spreads as the "credit view." The credit view offers several testable hypotheses above and beyond the narrower interest view.

[6]For example, the SEC website 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." See `https://www.sec.gov/answers/callablebonds.htm`. Much academic work is also supportive of this view (e.g., Banko and Zhou 2010).

2.1 Data

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

Our empirical analysis focuses on bonds that are callable at a predetermined fixed 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 prevailing interest rates when calling. Bonds can have either a fixed-price or a make-whole provision, or none, or both. Since make-whole calls involve paying above par, these calls transfer limited value.[7] We treat bonds that are only make-whole callable separately in our tests of bond features and pricing and ignore them in tests of call decisions and investment behavior of bond issuers. Bonds that have both make-whole and fixed-price call provisions are invariably *first* make-whole callable and *later* fixed-price callable. We treat such bonds as (fixed-price) callable if the fixed-price call period exceeds one year, and as make-whole otherwise. When nothing else is specified, a callable indicator refers to fixed-price call provisions. We remove convertible bonds (which might affect debt

[7]Elsaify and Roussanov (2018) suggest that issuing bonds with only "make-whole" call rights can be motivated by a desire to match the duration of assets and liabilities. Xu (2017) suggests that managing maturity structure may explain why issuers pay a premium to exercise "make-whole" calls and to repurchase through open market transactions or tender offers. Julio (2013) and Mao and Tserlukevich (2015) show that repurchasing through open market transactions or tender offers are unlikely to impact debt overhang.

overhang in different ways) and callable bonds with very low call prices (these are typically issued in conjunction with warrants).[8] Bonds may also embed a change of control clause. This feature protects bondholders in case of a takeover or buyout, and is less important in the setting we analyze.

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. We examine call decisions based on action variables in Mergent FISD, as well as the redemption file.

[TABLE 1 ABOUT HERE]

We obtain secondary market bond prices and yields from TRACE (2002–2017) and bond credit ratings from Mergent FISD. We collect treasury yields and credit spreads from the FRED database of the Federal Reserve Bank of St Louis.

We match the bond data to issuer data from Compustat. We compute 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. Book leverage is the total book value of debt over assets. We measure investment by [capital expenditures + R&D expenses + advertisement expenses], divided by the book value of assets.[9] Ratios are winsorized at 1% at both tails 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

[8] Convertible bonds account for 7% of all non-financial corporate bonds and 10% of callable bonds in our sample. 4% of the callable bonds are with very low call prices. Our results are robust if we include them.

[9] Our inferences are similar if we measure investment by capital expenditures divided by book assets.

did not own shares in the target firm prior to the bid and acquired 100% of the target firm through the bid. These filters yield 9,006 deals where information on target firms is available in Compustat. We define the variable "Target" to be one for any firm which is the object of a successful takeover the following year, zero otherwise. Summary statistics for the firm-year panel are presented in Table 2.

[TABLE 2 ABOUT HERE]

In our analysis of announcement returns for bondholders, we combine the price information from TRACE, the M&A sample from Thomson Financial's SDC, and bond data from Mergent FISD. We require the bonds to have at least two days of trading information during the event window, from one trading day before the announcement to five trading days after the announcement. We also require the bond to have at least two days with trading information during the four weeks leading up to the announcement ($t = -20$ to $t = -2$). These filters result in a sample of 807 bonds issued by 364 target firms.

To identify investment opportunity shocks, we use annual price changes of intermediate inputs for each industry. A decrease in input prices is a positive shock to investment opportunities. We obtain the price indices for inputs at the industry level at the annual frequency from the Bureau of Economic Analysis for our sample period from 1980 to 2015.[10] The price index is then matched to firms by industry (4-digit NAICS).

Many loans are callable, especially if they are issued as syndicated loans in the leveraged loan market (cf. Standard & Poor's 2009). To verify this wisdom, we examined data on 566 loans from LevFin Insights, a leveraged loan data provider. All 566 of these loans, issued in 2016 and 2017, were callable but often subject to some protection (most often a six-month

[10]Following Dasgupta et al. (2018), we take the Chain-Type Price Index for intermediate inputs by industry to measure input prices. According to BEA, the data are from GDP by Industry accounts released on November 5, 2015, as part of the annual revision to the industry economic accounts (IEAs). The data for 1947–1996 are from GDP by industries historical time-series released on February 19, 2016 and have been updated to be consistent with IEAs comprehensive revision. Statistics were prepared with methodologies that are unique to the GDP by Industry accounts and are for industries defined according to the 2007 North American Industry Classification System (NAICS).

period after issue when they were not callable). Eckbo et al. (2019) model the terms at which syndicated loans can be pre-payed (the equivalent of a bond call) and find that prepayment terms impact issuance yields. For Compustat firms that do not have bond data in FISD, our results remain if we assume their loans are callable if issuer rating is high-yield.

2.2 The prevalence and price of callable bonds

Figure 2 summarizes the incidence of fixed-price call features in U.S. corporate bonds issued between 1970 and 2017, sorted by initial maturity. High-yield (HY) bonds of all maturities are typically callable (76%). Investment-grade (IG) bonds of long maturities are often callable (35%). Unrated bonds are somewhere in between high-yield and investment-grade. Overall, 36% of corporate bonds are callable (see Panel A of Table 1). Financial bonds are excluded from our analysis, but these are also frequently callable (48%).

Several facts in Table 1 point toward a broad view of call features, beyond risk-free interest rates. First, many floating rate bonds are issued with call rights (see Panel A of Table 1). The yield on these bonds automatically falls with reference rates. Issuers of callable floating rate bonds are, therefore, not motivated by a view on risk-free interest rates, or the desire to hedge them. Instead, the existence of callable floating rate bonds points to a different function, including options on credit spreads and credit risk.

Second, the fact that high-yield bonds more commonly include call features suggests that credit risk motivates calls. Interest rate risk is comparable for IG and HY bonds of the same duration, but HY issuers have higher credit risk. These bonds are more likely to change in value due to credit quality improving or credit spreads tightening.

We can think of the "price" of including a call feature as the yield difference between a bond that was issued and the yield on a counterfactual bond with identical features except for call provisions. This is unobservable, but we can obtain an estimate of the price of

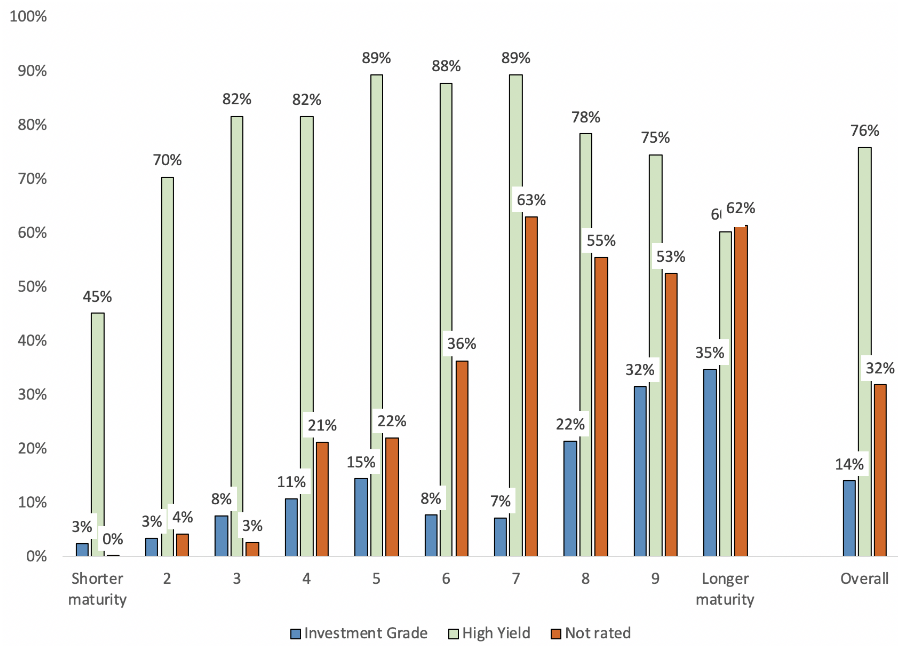

Figure 2: **Callable bond issuance, 1970–2017, by maturity deciles.** Bars indicate the fraction of non-financial corporate bonds issues that are callable, sorted by maturity at issue. Convertible bonds are excluded from the sample. Callable refers to bonds that can be called at a fixed price for at least one year. Bonds are sorted into deciles of time to maturity. The sort is separate for each rating group. Investment Grade (IG) is any bond rated BBB-/Baa3 or higher by S&P, Moody's, and Fitch, and High Yield (HY) bonds have lower ratings. The longest maturity deciles have an average maturity of 34.7 years (IG), 16.1 (HY), and 26.4 (NR).

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

[TABLE 3 ABOUT HERE]

In the first column of Table 3, the average yield difference for the fixed price call feature is 27 bps. As a benchmark, make-whole call features are associated with 16 bps higher yields (this is estimated with low precision and is borderline significantly different from zero). Note that the point estimate of 27 bps should not be interpreted as a universal price for call features: different issuers likely face very different effective prices and macro-economic factors such as interest rate volatility may create time-variation (Jarrow et al. 2010).[11] The point estimate does establish that calls are quantitatively important to bond yields in our sample. As a comparison, the 27 bps difference corresponds to the average yield difference associated with a two-notch difference in credit rating (e.g., A+ vs. A–) in our sample. In columns 2 and 3, we separate investment-grade and high-yield bonds. The estimated yield associated with a call feature on average is 16 bps for investment-grade bonds and 39 bps for high-yield bonds (these are different from each other at the 5% level). This suggests that credit risk is connected to call features.

2.3 The decision to call and secondary market bond prices

The credit view suggests that any reason a bond price exceeds the call price should provoke calls — this could be falling rates, falling spreads, and improving issuer credit quality. In Figure 3, we plot the annual hazard rate of bond calls against a bond's secondary market price at the end of the preceding year. The figure provides both a linear and a non-parametric fit. In both cases, there is a strong positive relationship between prices and calls.

For bonds traded below par, around 5% of bonds are called every year, and for bonds traded above par, the call incidence rises to as high as 40% for bonds trading 10% above par (this positive relationship is highly statistically significant).

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

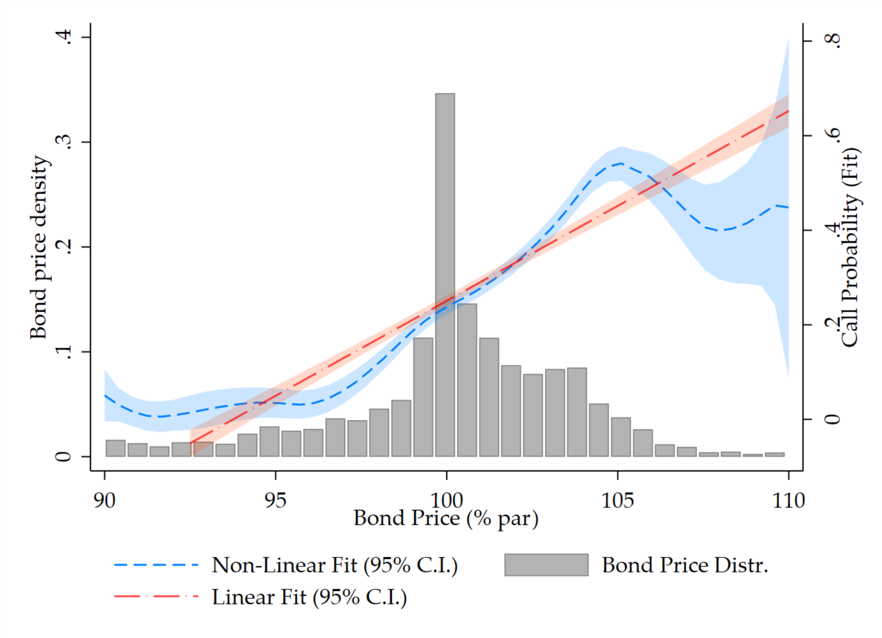

Figure 3: **Bond prices and the likelihood of a call.** This plot presents the estimated relationship between the bond price at previous year-end (last trade before year-end) and the likelihood of a call in the following calendar year. Two fits are estimated, linear and a locally smoothed, third-degree polynomial fit. The linear relationship is truncated at zero. The data contains 5,552 annual observations for 2,931 callable bonds. Confidence intervals assume independence across observations. A histogram of end of year secondary market bond prices is plotted for reference.

We use regression analysis in order to separate the impact of changes in interest rates, issuer credit risk, and credit spreads. We test the determinants of call decisions using a linear probability model panel of the hazard rate for calls (probit regressions give similar results), controlling for bond features such as remaining maturity as well as year fixed effects, which absorb most aggregate financial variation (e.g., interest rates, credit spreads) and macroeconomic conditions. Results are reported in Table 4.

[TABLE 4 ABOUT HERE]

The variables of interest capture firm credit quality: lagged changes in issuer credit ratings, market leverage changes, or bond price changes (these are all lagged so that calls in year t are predicted by changes in year $t-1$). Each measure of firm credit quality significantly pre-

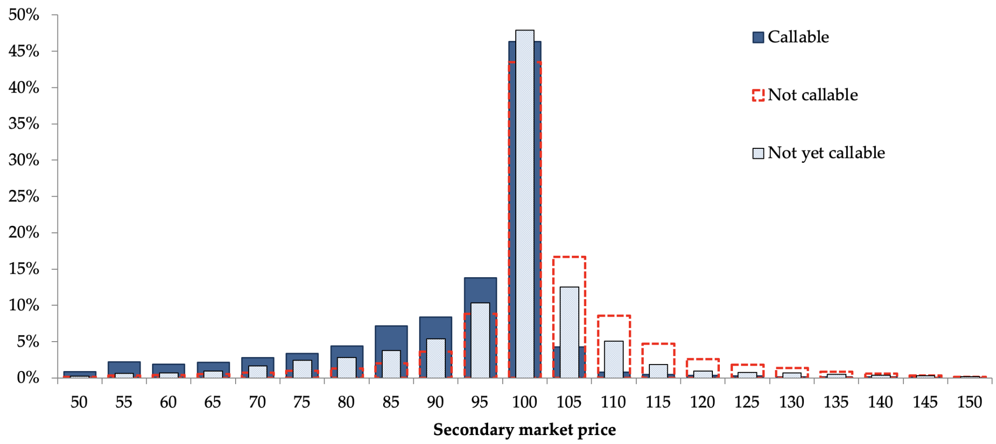

Figure 4: **Secondary market prices of callable and non-callable bonds, 2007–2016.** This figure presents the histogram of quarter-end prices of corporate bonds, 2007–16, constructed from the TRACE database. Bonds below $100 million of face value, with less than $1 million of transactions for the quarter, and with make-whole call provisions are dropped. The column headings indicate interval midpoints in percent of par. In other words, "100" contains all bonds trading in the interval [0.975,1.025] of par value. "Not callable" refers to bonds without a call provision. "Not yet callable" refers to any bond with a fixed-price call provision that has not reached its first call date and "Callable" to a bond that has reached its first call date.

dicts future call decisions, individually (columns 1 through 3) or together (column 4). The estimated economic magnitudes are significant: a one-notch rating upgrade (i.e., from A to A+) raises the call hazard rate by 1.3% (around 14% of the sample mean); book leverage falling the previous year raises the hazard rate by 3.1% (37% of the mean hazard), and a 10-bps drop in the bond yield raises the call hazard by 3.0% (14% of the mean hazard for bonds with market prices). The last column includes issuer controls: market-to-book, enterprise value, and lagged equity return. These variables do not change the estimate for the credit variable.

Given that prices are such a strong trigger of calls, we would expect the distribution of prices for callable bonds outstanding at any point in time to be thin at high levels. Figure 4 illustrates this point by comparing secondary market prices of non-callable bonds (which have no price "ceiling"), not-yet-callable bonds (which have not reached the first fixed-price call date, and therefore face a ceiling in the future, but not yet), and callable bonds (which face a price ceiling). As predicted, callable bonds are less often traded above par compared both to non-callable bonds and also compared to not-yet-callable bonds. For example, only 2.4% of callable bonds trade above 1.075 times par, whereas 11% of not-yet-callable bonds do so, and 21% of non-callable bonds. Similarly, 1.2% of callable bonds trade 117.5 or more times par, 3.7% of not yet callable, and 7.7% of non-callable bonds. The differences between price distributions are statistically highly significant. This implies that call provisions limit the potential upside for bondholders.[12]

Price and call data *jointly* paint a picture of substantial differences between callable and non-callable bonds in purely financial terms: callable bonds are issued with higher yields but get called when the price rises and therefore do not provide the same upside potential as non-callable bonds. These differences are realistically too large to reflect interest rates, suggesting that the broader credit view fits data better than the narrow interest view.

3 The real effects of bond callability

In this section, we develop hypotheses that callable bonds improve investment incentives by reducing ex-post debt overhang, a key insight from the credit view of callable bonds.

3.1 Base hypotheses development

The key intuition we explore relates to the issue of splitting value gains — especially from NPV-positive investment decisions — 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 (or other sources of value gain in enterprise value). The gain to the bondholders from the new investment is lim-

[12]In unreported tests, we find that bonds with make-whole provisions are traded above par much more often than callable bonds, consistent with the fact that make-whole calls are often paid much above par and do not limit creditors' upside.

ited to the ex-ante option value of the calls, and the kind of transfers of value to bond investors that causes debt overhang is limited. The shareholders' incentive to invest is therefore closer to first best with callable bonds than with non-callable. Because of the ability to take new investments, shareholders can be made absolutely better-off with callable bonds than they would be with non-callable debt, even though the call feature is costly. We state this formally:

Hypothesis 1. *All else equal, a firm's investment will be less affected by debt overhang if its debt is callable.*

To test this general hypothesis, we examine the elasticity of investment spending to shocks to investment opportunities for firms whose callable debt are on either side of the end of the protection period (treating this ex-ante assignment as random relative to the investment).

3.2 The effect of callability on acquisitions

We extend the standard framework to study debt overhang in the takeover market. This is a particularly interesting setting in which to study the effect of callability on real corporate decisions for a number of reasons. Chiefly, acquisitions are "credit positive" for target debtholders since after a takeover, the target firm's debt becomes the obligation of the merged entity. Because acquirers tend to be large and financially strong (see, e.g., Andrade et al. 2001 and Eckbo (2014)), this is good news for target bondholders, who stand to make a capital gain (cf. 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 second (and main) line of investigation examines whether callable bonds in a potential target's capital structure limits gains transferred to bondholders of targets and encourages takeovers. Since takeover acquisitions are harder to anticipate in advance for the managers (of the eventual target) than capital expenditure, the results connecting callable debt to takeovers will also be less affected by endogeneity (than those using capital investments).

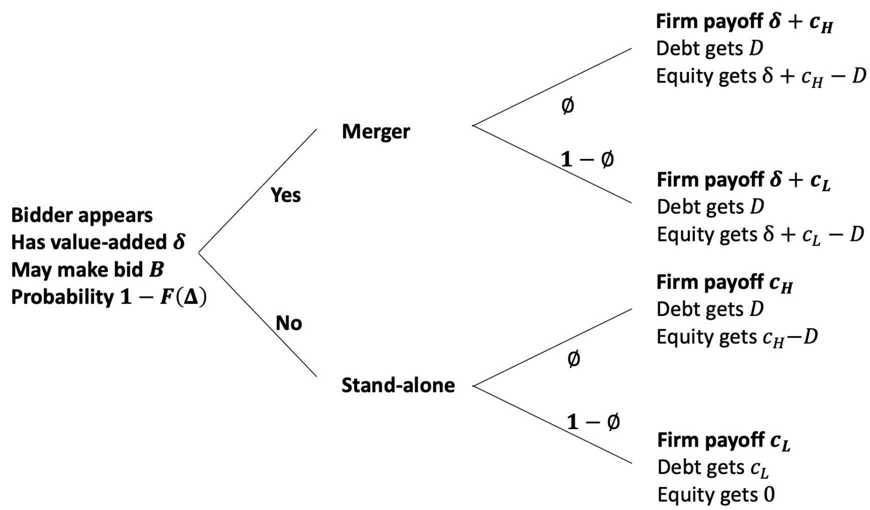

Figure 5: **Model timing**

Model set-up

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

The timing of the model is illustrated in Figure 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. If a deal goes through, the joint firm's cash flows are higher than stand-alone cash flows by δ, so that total payoff is: $c^{target} \in (\delta + c_L, \delta + c_H)$. Value-added ϕ is known to both owner and the bidder. For convenience, we assume that δ is drawn from a distribution F with $\delta > D - c_L$.[13] All agents are risk-neutral and maximize expected payoffs. Note that the first best is to do all mergers since δ is assumed to be positive (value-reducing bidders would never make winning bids, so this is without loss of generality).

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

Straight debt

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

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

[13] 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.

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 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 was 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 summarize the results with straight debt as follows:

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

The point of this result is two-fold. First, it establishes that debt overhang discourages value-enhancing takeovers, just like it discourages investment. Second, this is value-destroying ex-ante, suggesting that firms will take action to avoid it. One simple solution is to avoid debt altogether (cf. Myers 1977). We wish to 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.

Callable debt

We now consider how a right to call can reduce the debt overhang generated by risky debt. We assume debt can be called at some level $X < D$. This assumption implies that the debt will always be called just before repayment since repayment would be more expensive than calling. In other words, debtholder will never get D, at most X. By construction $\delta + c_L > X$, so that debt is always called after takeover; 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 (since it is a cumulative distribution function).

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 does. As a result, callable debt reduces debt overhang and increases the likelihood of successful takeovers.*

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

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

To test Hypothesis 2, we compare merger announcement returns of different types of bonds and look at frequencies of takeovers for different groups of firms. We exploit the end of the protection period of callable bonds as a quasi-random assignment to one category or the other. We also examine deregulation events associated with spikes in M&A activity for the same purpose.

4 Empirical evidence on the real effects of callability

In this section, we examine how callability may improve real efficiency by reducing debt overhang. The results presented in Section 2 show that the upside value in callable debt is limited. The key prediction of the credit view of callable bonds is that firms with callable bonds, all else equal, should be more willing to undertake additional investment because less value is "leaked" to debt holders. This is the mechanism developed more formally in the previous section, and in this section, we present empirical tests of this hypothesis.

Testing this prediction is challenging for two reasons. First, foregoing a positive NPV investment opportunity leaves few traces. This empirical challenge is directly related to why contractual remedies to debt overhang are so difficult — what is hard to measure is also hard to contract upon (cf. Grossman and Hart 1986 and Hart and Moore 1990). Second, the choice of capital structure is endogenous to investment opportunities, and we cannot naively assume that an empirical relationship between callable debt and investment decisions is causal in either direction. We develop a novel test design to tackle these challenges, using the takeover market as a laboratory. We also examine a more general setting using corporate investment.

4.1 Debt overhang in takeovers: bond announcement effects

Using panel data on for publicly listed firms, we examine whether callable debt is associated with higher takeover probabilities.[14] To handle the endogeneity of callable debt, we focus on changes in takeover incidence around initial call dates. Because acquisitions are large events with identifiable timing, it is possible to analyze announcement returns of the target's debt, and thereby document how callable debt changes takeover dynamics. Below, we first analyze announcement returns and then takeover incidence.

[14] Target debt is more important here than acquirer debt. This is because target creditors typically gain from takeovers, potentially benefitting from the higher creditworthiness of the acquirer as well as from synergies (Billett et al. 2004). The same is not true for acquirers, and acquirer debt need not generate overhang.

We first compare merger gains differ 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 perform the following regression:

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

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

[TABLE 5 ABOUT HERE]

In columns 1 through 4, we vary requirements concerning recency and frequency of trades in TRACE, as well as instrument maturity. The average announcement return in our sample is 4.3%, pointing to significant merger gains generally accruing to creditors of target firms on average. Notably, callable bonds have between 6.7% and 4.2% lower announcement returns than bonds that are not callable (see row 1), which *negates average gains* on announcement of merger bids: mergers are good news for holders of non-callable bonds, but not for holders of callable bonds. This base is consistent with the theory that callable debt protects against debt overhang by limiting "leakage" of value to debtholders.

4.2 Takeover incidence: matched samples around first call dates

We turn to tests of a central prediction of our model: firms with callable debt are more likely to be targets of acquisitions. The identification strategy has to address that, since issuing callable bonds is a choice, issuers of callable bonds are likely to differ from other firms. This difference may include being more appealing takeover targets. We exploit a unique feature of callable instruments to reduce concerns. Callable bonds have an initial period when they are *not callable*, the "call protection period". This period is often half the bond maturity (Xu 2017) and is specified at the time of issuance. We separate firms that have all issued callable bonds into a group of firms that have passed the first call dates (referred to as "Callable") and another group that is still in the protection period (referred to as "Not yet callable"). As we contrast Callable with Not yet callable instruments, many potential sources of endogeneity associated with the issuance of callable bonds and takeover probabilities are naturally eliminated. In this way, the protection period creates plausibly exogenous variation in callability.

Although many corporate issuers have either all callable bonds or none at all, the share of bonds that become callable also takes intermediate values in our sample. We handle this as follows: we define the "Callable" group to be those firm-year observations where some bonds have passed the first call date. The Callable dummy equals 1 if the firm's bonds are at least 20% callable in year t, and equals 0 if its bonds remain not-yet callable in year t and $t+1$. We use nearest neighborhood matching to select up to 5 control firms within the same Fama-French 12 industry and year that are closest in Book assets (log), Leverage, q, Age, the Total shares of callable and not yet callable, and the HY issuer rating indicator.

We first estimate the linear probability of takeover on this matched sample using OLS, to predict the probability of being acquisition targets in the following year.

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

where i denotes firm and j denotes its industry. The results are presented in Table 6.

[TABLE 6 ABOUT HERE]

Column 1 of Table 6 shows that firms in the "treated group", i.e., firms whose bonds have become callable, have 1.4% a higher probability of being acquisition targets in the following year. The result we obtained is after controlling for (Fama-French 12) industry-year fixed effects and firm characteristics at the time of matching (including Book assets (log), q, Leverage, and Age). To reflect that the two groups could also differ in respects such as bond maturity and covenant inclusion, we also control for the initial tenor of the bond and a dummy variable indicating whether the bond has any covenant.

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

By examining cases where a portion of outstanding bonds become callable, we cover a larger sample. However, the expected impact is smaller. As an alternative, we examine firm-year observations where a firm's entire stock of outstanding bonds becomes callable. Columns 3 and 4 of Table 6 report results. The OLS regression predicts a 1.9% increase in annual probability of a takeover, and the Cox proportional hazard model predicts that the takeover likelihood increases by 55%, when all of a firm's bond debt becomes callable. Many firms' liabilities include both bonds and bank loans. To isolate observations where the bond debt is particularly important in the debt structure, we examine a subsample of firms where bond debt exceeds 50% of total debt. We again match firms that are in the "Callable" group with those in the "Not yet callable" group. Table 7 reports the same set of regressions as Table 6 for this narrower sample. Point estimates are slightly higher than for the wider sample in all four specifications, and are significantly different from zero (OLS) or one (Cox).

[TABLE 7 ABOUT HERE]

Taken together, the tests presented in this section suggest that callable bonds facilitate takeovers, possibly unconditionally, and compared to having non-callable debt. This implies that wealth transfers from acquirer shareholders to target bondholders is less of a concern when debt is callable.[15]

Our identification strategy uses the protection period that is standard in length and predetermined at issuance, and contrasts takeover probabilities for similar firms on opposite sides of the boundary. One potential concern is that firms with an interest in becoming acquired may align the timing of the first call date on their bonds with future merger opportunities. This is probably far-fetched, since first call dates are determined at bond issuance, and is usually set in as a standard fraction of bond life. This would require considerable anticipation. One way to get around this concern is to look at shocks to the amount of merger opportunities in an industry. In the next section, we present evidence using a regulatory instrument.

4.3 Takeover incidence: evidence from deregulatory events

We dig deeper into the issue of identification and use deregulation as (pseudo-)natural experiments affecting merger events in our sample. We do so exploiting the enactment of Federal-level deregulation directly affecting entry, prices, and other elements of the industries' competitive environment, as well as the level of M&A activity (see Andrade et al. 2001, Ovtchinnikov 2013, and Campello and Gao (2017)). We are interested in examining whether a firm's bond callability affects its probability of being targeted in the affected industries post-deregulation.

Following prior papers, we create a list of 4-digit SIC industries witnessing transformative

[15]In unreported results, we have used alternative industry classifications and found similar results (three-digit SIC, FF30, and FF48). Our results remain if we use different thresholds to define the Callable dummy and longer event windows for takeovers.

deregulation events between 1977 and 1996.[16] We consider the first deregulatory shock and firms' share of the callable bond prior to the shock. Since the timing and consequences of large deregulation events are hard to anticipate, it is less likely for firms to issue callable bonds several years in advance to facilitate subsequent acquisitions.

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

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

where i denotes firm and j denotes the industry to which firm i belongs. The dependent variable, "Target", is a dummy that takes the value of 1 if 100% of the firm's shares was acquired by another firm in the year following the deregulation event, and 0 otherwise. Our main variable of interest, "Callable" is a dummy that equals 1 if the amount of the firm's callable bonds pre-deregulation exceeds 20% of all its debt, and 0 otherwise. We control for Book assets, Leverage, q, Age, all measured in the value prior to the deregulation. As shown in column 1 of Table 8, firms with more callable bond pre-deregulation have a significantly higher probability of being targeted in the post-deregulation window.

[TABLE 8 ABOUT HERE]

We conduct robustness checks of this important confirmatory finding. In column 2, we change the post-deregulation window from 1 year to 3 years. In column 3, we change the threshold of Callable to 50%. In column 3, we use 3 years to define the post-deregulation window and 50% to define the Callable groups. The results are consistent with the baseline results in column 1.[17] Overall, our estimations suggest that firms with a higher fraction of

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

[17]Because deregulation only affected a limited set of 4-digit SIC industries, we end up with a small sample after merging Mergent FISD, SDC and Compustat data. We validate our results on a broader sample by considering all HY loans to be callable. The results are consistent with the ones in Table 7.

their debt callable before the deregulation have a higher probability of being taken over 1–3 years after deregulation, implying lower debt overhang in firms with callable bonds.

4.4 Capital investment

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

To identify investment opportunity shocks, we use the annual intermediate input price changes at the industry level to capture the shocks originated from input costs.[18] We define high (low) investment opportunity, $HighOpp$ ($LowOpp$), to be a dummy that equals 1 if the percentage change in the industry input prices of the observation is among the firm's bottom (top) tercile, and 0 otherwise.[19]

We again utilize the call protection period for identification. The identifying assumption is that the exact timing of the protection period is not related to the desired response to the investment opportunities. If firms with more callable bonds are different from others (within the same industry-year) in some unobserved way related to their investment behavior, these omitted factors play a limited role when we compare the capital investment of the "Callable" group with that of the "Not yet callable" group.

We first consider the Callable group to be those firm-year observations where partial

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

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

bonds outstanding just passed the first call date. We use nearest neighborhood matching to select up to five control firms within the same Fama-French 12 industry and year that are closest in Book assets (log), Leverage, q, Cash flow, Age, and the Total shares of callable and not yet callable. We perform the following regression:

$$\begin{aligned} Investment_{i,t} = \alpha + \beta_1 \times HighOpp_{i,t-1} \times Callable_{i,t-1} + \beta_2 \times LowOpp_{i,t-1} \times Callable_{i,t-1} \\ + \beta_3 \times Callable_{i,t-1} + \gamma \times Controls_{i,t-1} + \theta_{j,t} + \varepsilon_{i,t} \end{aligned} \tag{4}$$

where i denotes firm and j denotes the industry to which firm i belongs. We control for industry-year fixed effects and a number of firm characteristics (including cash flow, and q) that affect investment. We also control for the initial tenor of the bond, remaining time to maturity in year t, and a dummy variable indicating whether the bond has any covenant. Our hypothesis predicts that $\beta_1 > 0$. The results are presented in Table 9.

[TABLE 9 ABOUT HERE]

The coefficient on the high investment opportunity and callable debt interaction term is positive for both the baseline sample (see column 1) and in a subsample where we restrict the bond/debt ratio to be above 50% (column 2). The evidence is consistent with our prediction that firms with more Callable bonds are willing to invest more when experiencing favorable investment opportunities. The estimated magnitudes are high: when at least 20% of bonds become callable, firms are able to scale up investment by an additional 1.7–2.3 percentage points, which accounts for 18–24 percent of the average investment.

We then consider the second Callable group consisting of firm-year observations where the entire bonds outstanding become callable. Estimates in columns 3 and 4 imply that when 100% of bonds become callable, firms can raise investment by an additional 4 percentage points, which accounts for nearly 50 percent of their average investment. The results in

Table 9 are consistent with the hypothesis that callable bonds reduce debt overhang and enable firms with high-yield issuer ratings to invest substantially more when facing favorable investment opportunities.

5 Concluding remarks

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

Our findings are critical in showing that a simple view of callability as a mechanism for allocating interest or duration risk between issuers and investors is incomplete. Call features also adjust the ex-post distribution of upside between equity and debt and therefore change corporate behavior. As such, callable debt plays an underappreciated role in reducing the agency costs associated with corporate leverage. These benefits of call features can help explain why callable debt is so prevalent. Our results also point more broadly to the importance of understanding the details of financial contracting in order to draw inferences about the vibrancy and efficiency of corporate investment.

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Table 1: **Selected summary statistics: bonds**

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

Panel A. Callable bonds

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

Panel B. Bond features at call

	Mean	Std. dev.	Min	25^{th} perc.	Median	75^{th} perc.	Max
Age (years)	7.0	5.2	-0.5	3.7	5.3	8.8	34.4
Remaining life (years)	7.9	8.3	0	2.6	4.7	10.0	91.9
Share of life	52%	24%	-4%	33%	51%	70%	100%

Panel C. Bond features in bond panel data set

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

Table 2: **Selected summary statistics: firms**

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

Panel A. Full sample

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

Panel B. Firms with positive callable bond debt

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

Panel C. Firms with zero callable bond debt

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

Table 3: **Yields at issue**

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

Dependent variable:	Yield to maturity		
Dep. Var. Mean (%):	6.016	6.016	6.191
	(1)	(2)	(3)
Fixed price callable	**0.266*** **	-	-
	(0.056)		
Fixed price callable (IG)	-	**0.137**	**0.162*** **
		(0.086)	(0.057)
Fixed price callable (HY)	-	**0.395*** **	**0.387*** **
		(0.081)	(0.080)
Make-whole callable	**0.161***	**0.173** **	**0.131***
	(0.089)	(0.088)	(0.073)
Covenant	**0.075**	**0.064**	**0.057**
	(0.087)	(0.087)	(0.059)
Year-month F.E. x Maturity	No	Yes	Yes
Year-month F.E. x IG	Yes	Yes	Yes
Year-month F.E. x Duration	Yes	Yes	Yes
Year-month-issuer F.E.	Yes	Yes	No
Year-issuer F.E.	No	No	Yes
Clusters	Issuer, time	Issuer, time	Issuer, time
R-squared	0.984	0.984	0.980
N	20,193	20,193	25,648

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

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

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

Table 5: **Bond returns around merger announcements**

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

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

Table 6: **Takeover probability: matched samples around the first call date**

This table presents regressions of takeover probabilities, using matched samples around the first call date. The initial sample consists of Compustat firms that have issued callable bonds. Takeovers are identified using SDC. "Callable" is a dummy that equals 1 if bonds have passed the first call date – either the callable share of bonds outstanding is at least 20% (columns 1 and 2) or 100% (columns 3 and 4), and 0 otherwise. The initial sample is matched to issuers with not-yet-callable bonds using Fama-French 12 industry, Book Assets (log), Leverage, q, Age (log), the share of bond debt that is callable and not yet callable, 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 (%):	0.030	0.030	0.035	0.035
	(1)	(2)	(3)	(4)
Model	OLS	Cox	OLS	Cox
Sample	All	All	All	All
Callable	**0.014*****	**1.442*****	**0.019*****	**1.551*****
	(0.004)	(0.150)	(0.008)	(0.236)
Othercharacteristics	Yes	Yes	Yes	Yes
Matching				
Treatment	Partial	Partial	Entire	Entire
Control	Not yet	Not yet	Not yet	Not yet
Industry X Year F.E.	Yes	Yes	Yes	Yes
# of unique firms	1,841	1,841	1,284	1,284
Observations	29,244	29,244	10,854	10,854

Table 7: **Takeover probability: firms where bond debt exceeds 50% of total debt**

This table presents regressions of takeover probabilities as in Table 6. The tests are implemented for a subsample of firms where bond debt exceeds 50% of total debt. All variables are defined as in Table 6. Standard errors are clustered at the matched pair level. One star (*) indicates significance at the 10% level, two stars 5%, and three stars 1% level (this refers to a t-test relative to zero for the linear probability models and relative to one for the Cox models).

Dependent variable:	Target			
Dep. Var. Mean (%): 0.033	0.033	0.034	0.034	
	(1)	(2)	(3)	(4)
Model	OLS	Cox	OLS	Cox
Sample	*Bond/debt* >= 50%	*Bond/debt* >= 50%	*Bond/debt* >= 50%	*Bond/debt* >= 50%
Callable	**0.022***** (0.006)	**1.667***** (0.201)	**0.032***** (0.012)	**1.988***** (0.429)
Othercharacteristics	Yes	Yes	Yes	Yes
Matching				
Treatment	Partial	Partial	Entire	Entire
Control	Not yet	Not yet	Not yet	Not yet
Industry X Year F.E.	Yes	Yes	Yes	Yes
# of unique firms	1,256	1,256	764	764
Observations	16,643	16,643	5,632	5,632

Table 8: **Takeover probability around deregulatory events**

This table reports regressions of takeovers probability around deregulations. The sample includes firms from 4-digit SIC industries that were deregulated between 1977 and 1996. The dependent variable, Target is a dummy equal to 1 if 100% of the firm's shares were acquired in one year (or three years) following the deregulation, and 0 otherwise. In columns 1 and 2, Callable is a dummy that equals 1 if the amount of the firm's callable bonds pre-deregulation exceeds 20% of all its debt. In columns 3 and 4, the threshold is 50%. We control for Book assets (log), Leverage (book), q, Age (log) 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	
	(1)	(2)	(3)	(4)
Model	OLS	Cox	OLS	Cox
Callable	**0.134*****	**0.168*****	**0.286*****	**0.337*****
	(0.041)	(0.077)	(0.055)	(0.112)
Firmcharacteristics				
Book assets (log)	-0.005	-0.027	-0.003	-0.025
	(0.010)	(0.018)	(0.009)	(0.018)
q	0.002	-0.006	0.003	-0.005
	(0.004)	(0.007)	(0.004)	(0.008)
Leverage	-0.104	-0.360***	-0.156**	-0.415
	(0.075)	(0.140)	(0.072)	(0.142)
Age	0.003	0.076	0.038	0.077
	(0.028)	(0.052)	(0.026)	(0.052)
Industry F.E.	Yes	Yes	Yes	Yes
Sample Treatment	*Callablebond* > 20%	*Callablebond* > 20%	*Callablebond* > 50%	*Callablebond* > 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 9: **Investment and callable debt: matched samples around the first call date**

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

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