Calling Nonconvertible Debt and the Problem of Related Wealth Transfer Effects

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An often-cited rule in corporate finance is that a firm should call a bond as soon as the bond's market price equals its call price. But, in fact, many callable bonds sell for more than their call prices. One explanation is that the implicit assumption that calls are executed so as to leave capital structure unchanged fails to hold in practice. This paper examines the impact of capital structure changes on optimal call policy and presents empirical evidence consistent with the results of that explanation.

■ A well-known rule in corporate finance is that a firm should call a bond as soon as its market price reaches its call price. It follows from this "textbook" rule that the price of a callable bond should never exceed its call price. In the market, however, prices of callable bonds often exceed the call prices.[1]

Many explanations have been offered for why firms delay calling and forcing conversion of their convertible debt. However, the reasons given for the delay in calling convertible debt center around the conversion feature and generally do not apply to nonconvertible debt. Relatively few authors examine why firms often choose to delay calling their nonconvertible debt. As the vast majority of callable bonds are nonconvertible, why firms delay calls of nonconvertible debt may be the more important empirical issue.

Kraus (1983) argues that the textbook call policy is optimal when there are no issuance costs associated with refunding debt. In a more detailed and rigorous analysis, Mauer (1993) shows that, given refunding transaction costs, it is always optimal to delay calling, and therefore, for callable bonds to naturally exceed their call prices. Fischer, Heinkel, and Zechner (1989) also show that callable bonds can exceed their call prices when investors face proportional costs of refunding called debt.[2]

Although refunding costs may play an important role, they alone cannot explain why firms delay calling their debt, because the majority of called bonds are not refunded. Furthermore, even bonds that, when called, are not refunded frequently sell for more than their call prices. These facts suggest that other factors, besides refunding costs, induce firms to delay calling their nonconvertible debt.

We develop an additional explanation of why the textbook policy may not be optimal for the firm. When a firm has only one issue of debt outstanding, minimizing the value of the debt issue is equivalent to maximizing the value of the equity. In this case, the textbook policy is optimal.[3] In the more common case of multiple debt issues, however, minimizing the value of a bond may not be equivalent to maximizing the value of the equity. This is because the value of other debt issues may also be affected by calling the bond. Consequently, in these circumstances, the textbook policy may not be optimal for the firm.

We illustrate this with a simple example for a firm with two issues of debt outstanding. The textbook policy is optimal only if the firm finances its call in a way that leaves its capital structure exactly the same as before the call. We show that even a minor change in the firm's capital structure may make it optimal to delay calling the bond. A direct

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[1]We call this rule the "textbook" rule since many standard corporate finance textbooks state the rule in exactly this way with few if any of the necessary caveats. One important exception is Emery and Finnerty (1991), who provide an excellent discussion of the implicit assumptions underlying this rule.

[2]Other related work includes Barnea, Haugen, and Senbet (1980), Bodie and Taggart (1978), Brick and Palmon (1993), Dunn and Spatt (1986), Emery, Hoffmeister, and Spahr (1987), and Vu (1986).

[3]For example, see Kraus (1983) and Brennan and Schwartz (1977).

implication of this finding is that the price of a callable bond can exceed its call price when the firm calls its debt optimally.

While the impact of capital structure on optimal call policy may not be surprising from a theoretical perspective, it is quite relevant empirically. First, the evidence we find suggests that firms seldom maintain the same capital structure when calling a debt issue. This means that, even in the absence of refunding costs, firms generally have an incentive to deviate from the textbook call policy. Second, the characteristics of bonds selling above their call prices appear consistent with the empirical implications of this analysis. Third, our analysis demonstrates the sensitivity of the optimal call policy to small changes in the size of the refunding issue. Taken together, these results provide new insights about optimal call policy and complement previous research about the behavior of callable bond prices.

I. Optimal Call Policy

Mauer (1993) and others show that refunding costs may induce firms to deviate from the textbook policy in calling their bonds. Even when there are no costs associated with refunding debt, an example will illustrate that firms with multiple debt issues may have incentives to deviate from the textbook policy. We focus on the simplest possible capital structure, although the analysis can easily be extended to more realistic capital structures.

We develop our analysis in the standard continuous-time framework of Black and Scholes (1973) and Merton (1974). Let V denote the value of the assets of a firm. The value is random and has risk-neutral dynamics given by

$$dV = rVdt + \sigma VdZ \tag{1}$$

where r is the constant riskless rate.[4]

Assume that the firm has two coupon bonds outstanding. The first bond is senior to the second bond, and only the senior bond is callable. The maturity date of both bonds is T, and the face amounts of the bonds are F_1 and F_2. Let c_1 and c_2 denote the coupon payments for the two bonds. The call price of the senior bond is K.

For simplicity, we assume that the senior bond can be called only at time zero and that the bonds have one remaining coupon payment, which will be paid in addition to the principal amount at time T. Recall that in this framework the value of the equity in the firm can be viewed as a call option on the assets of the firm, V, where the strike price of the call is equal to the sum of the promised payoffs to the senior and junior debtholders $F_1 + F_2 + c_1 + c_2$.

At time zero, stockholders must decide whether to call the senior bond. Let α denote the fraction of the face amount of the called debt that is refunded, where refunding is assumed to be costless. For the present, we also assume that the debt is refunded by issuing new senior debt with a coupon payment, c^*, determined so that the debt sells at par.

The values of the bonds and the value of the equity in the firm at time zero depend on whether the senior debt is called and how the debt is refunded. These values are tabulated in Table 1. The term C(V, F) denotes the value of a European call option on V with strike price, F, and maturity, T, as given by the Black-Scholes formula.

The optimal policy is to call the senior debt when the value of the firm V at the call date is greater than or equal to some critical value, which we designate V^*. Since stockholders maximize their own wealth, the value of the equity at time zero is

$$\max[C(V, F_1 + F_2 + c_1 + c_2), C(V - K + \alpha F_1, \alpha F_1 + F_2 + c^* + c_2)] \ . \tag{2}$$

Consequently, the optimal value is determined by solving Equation (3) for V^*

$$C(V^*, F_1 + F_2 + c_1 + c_2) = C(V^* - K + \alpha F_1, \alpha F_1 + F_2 + c^* + c_2) \ . \tag{3}$$

In contrast, the textbook policy is to call the senior debt when the value of V at the call date is greater than or equal to the value $\hat{V}$ at which the value of the senior debt just equals the call price. This value is given by solving Equation (4) for $\hat{V}$

$$\hat{V} - C(\hat{V}, F_1 + c_1) = K \ . \tag{4}$$

As a numerical example, let $F_1 = 100$, $c_1 = 6$, $F_2 = 100$, $c_2 = 8$, $r = 0.04$, $\sigma = 0.20$, $T = 1$, and $K = 101$. The coupon rate for the refund debt c^*, the textbook policy $\hat{V}$, and the optimal call policy V^* are reported in Table 2 for different assumptions about the percentage of the face amount of the debt refunded.

The numerical examples given in Table 2 illustrate a number of important points. First, Table 2 shows that the textbook policy is optimal only when $\alpha = 1.01$. This is because that $\alpha = 1.01$ is the only refunding strategy that holds the capital structure of the firm fixed.

To see this, note that the senior bond represents a claim of $F_1 + c_1 = 100 + 6 = 106$ on the assets of the firm at time T. After calling and refunding the senior debt, the new senior

[4]Since r is assumed to be constant, changes in bond prices are driven by changes in firm value and credit quality rather than by changes in the term structure.

Table 1. Value of the Firm's Securities

The market value for each of the firm's securities is given for the case where the debt is not called and the case where the debt is called.

Security	Value if Not Called	Value if Called
Senior Debt	$V - C(V, F_1 + c_1)$	K
New Senior Debt	0	αF_1
Junior Debt	$C(V, F_1 + c_1) - C(V, F_1 + F_2 + c_1 + c_2)$	$C(V - K + \alpha F_1, \alpha F_1 + c^*) - C(V - K + \alpha F_1, \alpha F_1 + F_2 + c^* + c_2)$
Equity	$C(V, F_1 + F_2 + c_1 + c_2)$	$C(V - K + \alpha F_1, \alpha F_1 + F_2 + c^* + c_2)$

Table 2. The Textbook vs. the Optimal Call Policy for Different Levels of Refunding

The callable senior issue has a face value of 100, a coupon payment of 5, and is callable at 101. The junior issue has a face value of 100, a coupon payment of 8, and is not callable. The time until maturity is 1 year, the interest rate is 4%, and the annualized standard deviation of returns on the firm's asset is 20%. The refunding coupon is the coupon payment necessary for the refunding debt to sell at its face value. Premium over call is the maximum difference between the value of the callable bond and its call price of 101.

Proportion Refunded	Refunding Coupon	Textbook Policy	Optimal Policy	Premium Over Call
0.00	0.000	133.68	286.59	0.84
0.25	1.020	133.68	285.17	0.84
0.50	2.040	133.68	280.35	0.84
0.75	3.060	133.68	265.68	0.84
0.90	3.673	133.68	238.12	0.84
0.95	3.878	133.68	213.71	0.84
0.99	4.095	133.68	162.13	0.78
1.00	4.397	133.68	144.41	0.50
1.01	5.000	133.68	133.68	0.00
1.02	5.796	133.68	127.16	0.00
1.05	8.757	133.68	117.04	0.00

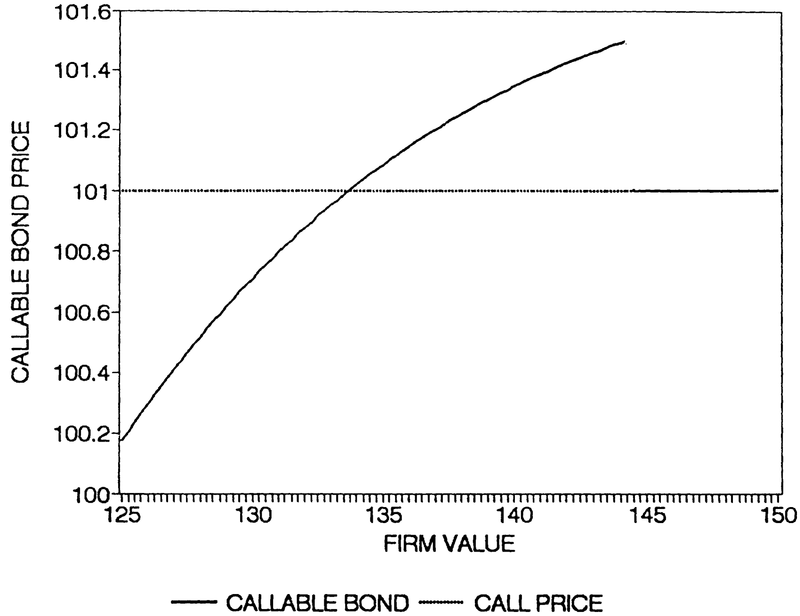
debt also represents a claim of $\alpha F_1 + c^* = 101 + 5 = 106$ on the assets of the firm. Because neither the position of the junior debt nor the value of the firm is affected by refunding the senior debt, the value of the junior debt is unaffected by the transaction. Because of this, the textbook policy of minimizing the value of the senior debt coincides with the optimal policy of maximizing the value of the equity.

In fact, firms seldom call their debt in a way that holds the capital structure of the firm exactly fixed. Table 2 shows that the optimal call strategy can differ from the textbook policy when α is only slightly different from 1.01. For example, when is 1.00, the optimal strategy is to call the bond when $V > 144.41$. In contrast, the textbook policy is to call when $V > 133.68$. Thus, V^* is more than 8% higher than $\hat{V}$ even though the capital structure changes only slightly.

In general, when $\alpha < 1.01$, the optimal call policy delays calling the bond beyond the point implied by the textbook policy. The intuition for this is that some of the wealth transferred from senior bondholders accrues to the junior bondholders because the change in the capital structure promotes their claim. Because of this, stockholders have less of an incentive to call the senior debt and then delay calling until the value of the firm is higher. When the stockholders do call the debt, the value of the firm is such that the probability of a default is much lower than is the case for the textbook policy. This means that there is a smaller transfer of wealth to the junior bondholders associated with the call of the senior debt. The opposite is true when $\alpha > 1.01$. In this case, the optimal policy calls the senior debt earlier than implied by the textbook policy.

It follows from this example that the value of a callable bond can exceed the call price when the bond is called

Figure 1. Graph of the Value of the Callable Senior Bond



optimally. When $\alpha < 1.01$, the callable bond takes values greater than the call price in the range $\hat{V} < V < V^*$. This is shown in Figure 1, which graphs the value of the senior debt at time T as a function of V. In Figure 1, the call price of the bond is 101 and the percentage of the face amount of the bond refunded is 100. With these parameters, the optimal policy is to call when the value of the firm equals 144.41. Table 2 also reports the maximum difference between the value of the callable bond and the call price. This difference is termed the premium over the call price. When $\alpha = 1.00$, the value of the callable bond can be as high as 101.50 before it is optimal for the firm to call the debt. Similarly, the value of the callable bond can reach 101.84 when $\alpha = 0.95$. Thus, small deviations from capital structure neutral refundings can generate premiums in callable bond values. Note that 0.84 is the highest premium the callable bond can have in this setting because the value of the bond is bounded above by the value of a riskless bond.[5]

Figure 1 also shows that the value of senior debt on its call date is discontinuous at $V = V^*$, jumping from 101.50 on the left of V^* to 101.00 on the right of V^*. This discontinuity arises because some of the wealth of the senior bondholders is transferred to the junior bondholders when the capital structure of the firm is affected by calling the debt. Note, however, that there is no discontinuity in the value of the equity at V^*: the maximizing behavior of the firm guarantees that the value of the equity satisfies a continuity condition at V^*.

Because of the discontinuity in the value of the senior debt on its call date, the value of the senior debt prior to the call date, although a continuous function of V, can be very sensitive to small changes in the value of V.[6] In fact, the price risk of the senior debt, in both absolute and percentage terms, can be larger than that of the equity in the firm. Furthermore, over some range of V, the value of the senior debt can be shown to be a decreasing function of V. These results illustrate that the behavior of callable bond prices implied by the optimal policy can be quite different from that implied by the textbook policy.[7]

Finally, our examples assume that senior debt is refunded with debt of similar priority. Our basic conclusions are similar for other initial capital structures and other capital structure changes. As long as the capital structure of the firm is changed as a result of the call, the textbook policy fails to be optimal, and the value of the callable bond may exceed its call price.

Similarly, we also assume that both debt issues have the same maturity, although the implications of the analysis are exactly the same if this assumption is relaxed. The only

[5]Vu (1986) finds that the average premium for bonds selling above their call price is on the order of 1 to 2%.

[6]The value of the senior debt is a discontinuous function of V only at time T.

[7]Fischer, Heinkel, and Zechner (1989) and Mauer (1993) also show that callable bond prices can behave in counterintuitive ways for some values of the underlying variables in their models.

Table 3. Comparison of Called Bonds and Their Refunding Issues

Results are for the industrial firms that refunded one or more bond issues from August 1992 to August 1993. In the case of multiple issues, a composite issue is formed by weighting the characteristics of individual issues by their face amount outstanding.

	Average Difference: Refunding Bond - Called Bond	Median Difference: Refunding Bond - Called Bond	Percent Greater or Equal to for Refunding Bond (%)
Coupon Rate (%)	-2.50	-2.09	8
Maturity (years)	4.58	6.32	71
Face Value ($mm)	148.1	56.5	71
Market Value ($mm)	96.8	56.5	67

difference is that the option prices would be given by Geske's (1979) compound option pricing formula rather than the Black-Scholes formula.

II. The Practice of Refunding

The textbook policy is optimal only if the firm's capital structure does not change in the process of calling a bond issue. Equivalently, the bond has to be refunded with an issue that has exactly the same remaining interest payments, sinking fund provisions, and option features as the original issue. This is the notion of debt service parity discussed in Emery and Finnerty (1991). While this is the correct way to measure the refunding effect, as they point out, the actual transactions may differ significantly.

There are, in fact, several reasons why it is highly unlikely to see bonds actually refunded by maintaining debt service parity. First, many callable bonds are not refundable, i.e., contain covenants that specifically prohibit firms from financing calls by selling new bonds.[8] Second, market conventions governing new issues (e.g., selling bonds at par and offering standard call and sinking fund provisions) hamper efforts to structure the refunding issue in a way that leaves the capital structure unchanged. Third, firms may have capital structure objectives that conflict with a completely neutral refunding.

To demonstrate that exact refunding or refunding neutrality is exceptional, we collected Moody's data on industrial bonds that were called between August 1992 and August 1993. Of the 83 issuers that called one or more issues, 57 (69%) did not refund the debt at all (defined as selling a public issue from two months before a call to two months after a call).[9] The 26 issuers that did refund their debt by no means avoided capital structure changes. The data reported in Table 3 show that the refunding operations altered coupon rates, maturities, face values, and market values. As expected, refunding bonds are almost always offered at a coupon rate lower than that of the called bond. While maturities, face values, and market values are usually greater for the refunding issue, a respectable fraction of the sample exhibits the opposite behavior. Note that refunding with longer maturities, smaller face values, and smaller market values corresponds to the case of α less than the value that gives refunding neutrality.

III. An Empirical Analysis

One clear implication of the example presented in Section I is that the market price of a callable corporate bond can exceed its call price. To examine this implication, a sample was collected of all currently callable industrial bonds listed in the August 1992 edition of *Moody's Bond Record*.[10] Supplemental information was gathered from the 1992 edition of *Moody's Industrial Manual* covering the period August 1991 to August 1992. Restricting the sample to industrial firms avoids the complicating effects that government regulation may have on the call policies of public utilities, municipalities, or banks.[11]

The sample of 727 issues reveals that the central implication of the textbook policy frequently does not obtain in practice; market prices exceed call prices in 258 cases (35.5%) of the sample.[12] For these 258 bonds, Table 4 shows

[8]For example, 24% of the bonds in our sample of bonds selling at a premium to their call price have explicit restrictions against refunding. Of course, there may be ways that circumvent these restrictions, e.g., see Emery and Lewellen (1984) and Thatcher (1985).

[9]In theory, this definition may understate the extent of refunding because corporations may borrow from banks or through private placement. In these cases, however, the structure of the loans will differ substantially from that of the called public debt and, therefore, may not be indicative of refunding neutrality.

[10]Bonds in default are excluded from the sample.

[11]Equityholders of public utilities, for example, may not find it worthwhile to call a bond if that action would result in a lower computed cost of capital for rate-setting purposes. See Kalotay (1979).

[12]Of the issues called but not refunded over the subsequent year, i.e., from August 1992 to August 1993, 46% sold for more than their call prices. This means that market prices exceed call prices even when firms incur no

Table 4. Summary Statistics for the Premium of Market Prices Over Call Prices

These summary statistics are based on the currently callable industrial bonds listed in the August 1992 edition of *Moody's Bond Record* with market prices exceeding their respective call prices. All dollar entries are per $100 face value.

	Mean ($)	Standard Deviation ($)	Minimum ($)	Median ($)	Maximum ($)	Number
Bid Price	2.00	2.84	0.03	0.95	14.13	185
Sale Prices	1.39	1.86	0.01	0.89	6.13	73
All Prices	1.83	2.61	0.01	0.90	14.13	258

Table 5. Rating Frequency Distributions

The distributions are for the sample of currently callable bonds with market prices in excess of their call prices and the sample of currently callable bonds with market prices less than or equal to their call prices.

	Market > Call		Market ≤ Call	
Rating	Number	Percent	Number	Percent
Aaa	19	7.7	62	13.8
Aa	28	11.3	78	17.3
A	105	42.3	111	24.7
Baa	40	16.1	58	12.9
Ba	21	8.5	42	9.3
B	31	12.5	61	13.6
Caa	4	1.6	20	4.4
Ca	0	0.0	18	4.0
Total Rated	248	100.0	450	100.0
Not Rated	10		19	
Total	**258**		**469**	

that the difference between the market price and the call price averages $1.83 per $100 face value and has a median value of $0.90 per $100 face value.

Moody's Bond Record provides two types of price quotations, bid prices and sale prices. As the labels imply, the former are price quotations, while the latter are transaction prices. To be certain that the existence of these premiums over the call price is not because of stale price quotations, Table 4 also reports separate summary statistics for bid prices and sale prices.

Neither the means nor the medians of the two samples are significantly different from each other at the 0.05 level. Nevertheless, the averages and maximums of the two samples suggest that the sample of bid prices contains more particularly large premiums over the call price than does the sample of sale prices. Yet, clearly premiums exist and cannot be explained away as artifacts of stale prices.

Callable bond prices can exceed call prices whenever the bonds are equal to or senior to the issuer's other outstanding bonds. Of the 258 issues selling at a premium to their call prices, 82% are equal to or senior to other public debt of the same issuer. Furthermore, this percentage underestimates the presence of other issues because private debt is not included. In any case, callable bonds selling at a premium to call prices cannot be characterized as unusual.

Our results have another important empirical implication. The extent to which a call of a particular issue transfers value to equal or junior debt depends on the bonds' credit quality. The effect will not be large for nearly riskless debt, but it can

refunding costs. Alternatively, refunding costs cannot fully explain the presence of these premiums. Mauer (1993) finds similar results for a sample of industrial bonds in November 1991.

be expected to increase as credit quality deteriorates. This argues that bonds selling at a premium to their call prices are likely to have relatively low credit ratings. On the other hand, because bonds with particularly low credit ratings will not have values anywhere near their call prices, these bonds will not appear in the sample of bonds selling at a premium to their call prices.[13]

Table 5 shows the rating frequency distributions for the sample of bonds with market prices above their call price and for the sample of bonds with market prices less than or equal to their call price. The two distributions are quite different, and a χ^2 test easily rejects the independence of rating and the relation between market and call prices.

Furthermore, the differences between the distributions are consistent with the theoretical insights of this research. Particularly high credits, namely, Aaa and Aa, for which the transfer of value associated with calling the bond is small, appear less frequently in the sample of bonds selling above their call price. Bonds of lower quality, namely, A and Baa, appear more frequently in that sample because the transfer of value is relatively large. Finally, bonds of the lowest quality, namely, Ba and below, appear less frequently simply because their prices are likely to be well below par, call option or not.

IV. Conclusion

Kraus (1983) and Mauer (1993) show that firms may choose to delay calling their debt when refunding called debt is costly. While the costs of refunding may very well play an important role, our empirical evidence indicates that these costs cannot fully explain why firms delay calling their debt. We show that, in the presence of multiple debt issues, the textbook policy is optimal only when a firm refunds callable bonds in a way that leaves capital structure unchanged. Furthermore, optimal call policy is sensitive to small changes in capital structure. As a result, it may be optimal for firms with multiple debt issues to delay calling their bonds, and callable bond prices may rationally exceed their call prices.

This reexamination of the textbook policy is important, because the empirical evidence indicates that callable bonds frequently sell for more than their call prices and that firms seldom hold their capital structure fixed when calling bonds. Also, an examination of the characteristics of bonds that trade at a premium to their call price appears to provide support for the empirical implications of our analysis.

These results provide additional insights about optimal call policy and complement earlier research about the behavior of callable bond prices. ■

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[13]Call prices are almost always higher than or equal to the face value of the bond.