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5 Valuing Financial Flexibility

Scott P. Mason

5.1 Introduction

Two facts that corporations, underwriters, and investors have been forced to confront are increased capital market volatility and increased complexity in the design of securities. A seemingly endless list of new security ideas has compounded the already difficult problem of making sound issuance, underwriting, and investment decisions in highly volatile markets. However, these two facts, increased volatility and increased complexity, are not unrelated. Virtually all of the complexity in securities can be viewed as the inclusion of different options in a straight debt contract. Even such common debt features as call provisions and call protection can be viewed as options. The value of a call provision is the value of an option to redeem debt at a fixed price prior to maturity, and the value of call protection is the value of shortening the life of that option. Given the fact that the value of options is driven most significantly by volatility, the advantage of including options, that is, financial flexibility, in securities has increased with increased market volatility. This would appear to explain why corporate issuers and institutional investors have shown substantial interest in securities which improve their flexibility in volatile markets. In low-volatility markets, corporations and investors would not lose a great deal of flexibility if options were excluded from the design of securities and would not make large valuation errors if options were ignored in valuing securities. But given that options are more valuable in a volatile market, significant valuation errors could result from ignoring options or valuing them through possibly outdated rules of thumb. There-

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fore, techniques which can consistently reflect the role of volatility in the value of options or flexibility should be of interest to issuers, underwriters, and investors.

A major breakthrough in the valuation of options came in 1973 when Fisher Black and Myron Scholes presented a technique for valuing calls and puts written on common stock. While their findings had an immediate and significant impact on the stock option markets, Black and Scholes offered a qualitative insight which may prove of even greater practical significance than their famous quantitative formula: corporate liabilities and covenants can be viewed as combinations of simple option contracts. This generalization of option pricing models to corporate securities and covenants became known as Contingent Claims Analysis (CCA).

This paper summarizes the results of some research by Jones, Mason, and Rosenfeld (JMR) (1984) and presents some new results, which test the ability of a CCA model based on Black and Scholes's option pricing principles to predict the market price of callable corporate debt, and therefore, the price of such common debt covenants as call provisions and call protection. This research had its origin in some earlier work (JMR 1983) done for the National Bureau's conference on corporate capital structures in the United States. In addition, some numerical CCA results are reported which demonstrate the impact of changing interest rate volatility on the value of call provisions and call protection. First, however, the paper briefly reviews the basics of option pricing and demonstrates the significance of option pricing to pricing corporate securities and individual covenants.

5.2 Corporate Liabilities as Options[1]

To understand the relationship between corporate liabilities and options, consider first the most fundamental options: calls and puts. An American call option, whose price is denoted by C, gives its owner the right to purchase an asset, for example, one share of stock, with current price S, at an exercise price, X, on or before an expiration date which is T time periods from now. The call option owner will only exercise his right to buy if it is to his advantage. Figure 5.1 depicts the value of the call option as it depends on the stock price on the expiration date. Should the stock price on the expiration date be less than the exercise price, then the call option owner will not exercise his right to purchase the stock and the option will expire worthless, that is, $C=0$. If, however, the stock price is greater than the exercise price, then the call option will be worth $S-X$, the difference between the stock price and the exercise price. An option is

1. This section of the paper borrows from Mason and Merton (1985), which more fully develops the concepts of corporate liabilities and covenants as options.

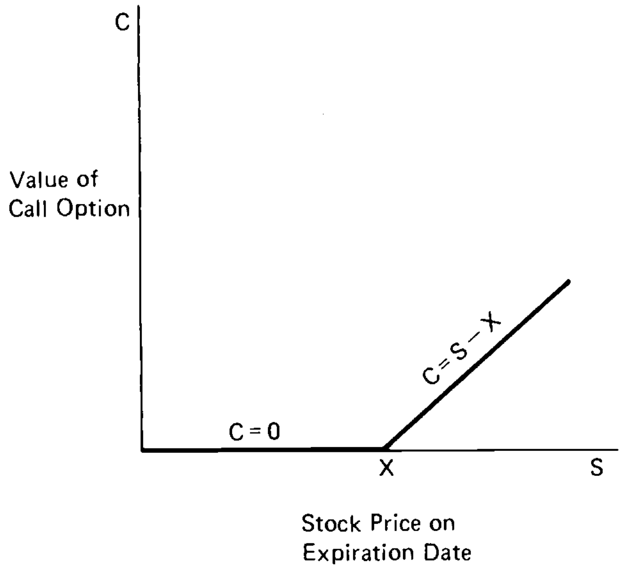

Fig. 5.1 Payoff to call option

termed "American" if it can be exercised on or before the expiration date and "European" if it can be exercised only on the expiration date.

Clearly, a call option pays off more the higher the underlying stock price at expiration. If the volatility of the stock increases, then the probability increases that the stock price will be higher at expiration. It is also true that an increase in volatility increases the probability that the stock price will be lower at expiration, but the effect of a lower stock price on the expected payoff to an option is bounded since the option holder has the right not to exercise—that is, not to surrender the exercise price—if it is not in his best interest. Therefore, increased volatility increases the expected payoff to the option and increases the option's value.

An American put option, P, gives its owner the right to sell one share of stock, S, at an exercise price, X, on or before its expiration date T periods from now. Again, the put option owner will only exercise his right to sell if it is to his advantage. Figure 5.2 depicts the value of the put option on its expiration date. If the stock price on the expiration date is greater than the exercise price, then the put option owner will not exercise his right to sell the stock and the put option will expire worthless, $P=0$. However, should the stock price be less than the exercise price, then the put option owner will exercise his right to sell the stock and the put option will be worth $X-S$, the difference between the exercise price and the stock price. The expected payoff to the put also increases given increased volatility since the probability that the stock price will be lower increases and the put

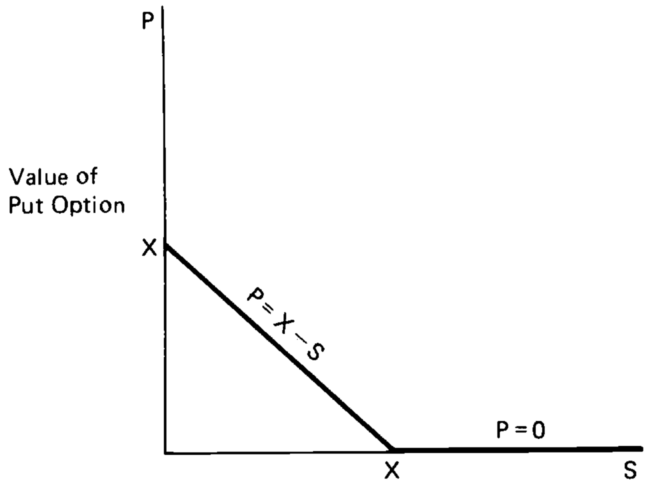

Fig. 5.2 Payoff to put option

owner need not exercise if it is not to his advantage, that is, if the stock price is above the exercise price.

An important relationship between European call and put prices can be derived from figures 5.1 and 5.2. Consider buying a European call and selling a European put on the same stock, with the same exercise price and expiration date. The net investment is

$$c - p.$$

The value of this investment position at expiration of the options is depicted in figure 5.3. The value of the investment position on the expiration date is $S - X$, the difference between the stock price and the exercise price. The investment can have negative value if the stock price is below the exercise price because the call will expire worthless and the put will be exercised against its seller. However, there is another investment position involving no options which can replicate the payoff depicted in figure 5.3. Consider buying one share of stock, S, borrowing on a discount basis X dollars for T time periods at rate r, that is, the proceeds from the loan will be $X(1 + r)^{-T}$ allowing for discounting. This second investment is then

$$S - X(1+r)^{-T}.$$

In T periods the value of this position will be $S - X$, since the position owns one share of stock and owes X dollars. But, if these two positions have precisely the same value in T time periods, then it must be true that the initial net investment necessary to establish the positions is the same:

$$c - p = S - X(1+r)^{-T}. \tag{1}$$

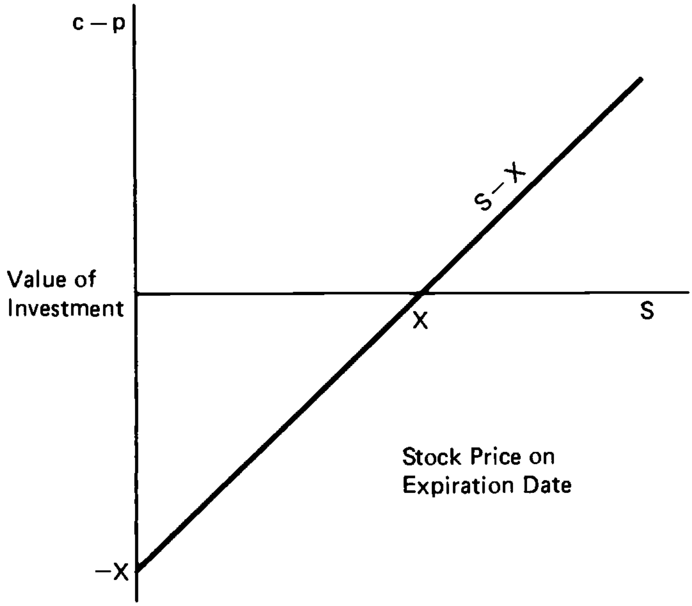

Fig. 5.3 Payoff to investment position

Expression (1) is known to professional traders as "put-call parity." The expression simply says that prices in the call, put, stock, and lending markets must be such that (1) is always true. If this were not the case, traders would simply buy the lower-priced alternative and sell the higher-priced alternative and earn an immediate riskless return on zero net investment.

With these fundamental options properties as background, the correspondence between options and corporate liabilities can now be established. Consider figure 5.4, the economic balance sheet of a simple firm which has only two liabilities: equity, *E*, and a single issue of zero-coupon debt, *D*, where the equity receives no dividends and the firm will issue no new securities while the debt is outstanding.

	D
V	E
V	V

Fig. 5.4 Firm's economic balance sheet

The left-hand side of the balance sheet represents the economic value, V, of the firm. The right-hand side lists the economic value of all the liabilities of the firm.

Figures 5.5 and 5.6 depict the value of equity and risky debt as they depend on the value of the firm on the maturity date of the debt. If, on the debt's maturity date, the value of the firm is greater than the promised principal, $V > B$, then the debt will be paid off, $D = B$, and the equity will be worth $V - B$. However, if the value of the firm is less than the promised principal, $V < B$, then the equity will be worthless, $E = 0$, since it is preferable to surrender the firm to the debt holders, $D = V$, than to repay the debt. Both equity and risky debt are contingent claims securities whose value is contingent on the value of the firm.

Now compare figures 5.1 and 5.5. Equity in the presence of zero-coupon risky debt is directly analogous to a European call option written on the firm value, V, with an exercise price, B, equal to the debt's promised principal and an expiration date equal to the maturity date of the debt. In other words, equity can be viewed as a call option with the right to buy the firm for B dollars T time periods from now.

Now return to the put-call parity result, (1), for options demonstrated earlier. In the characterization of corporate liabilities as options, the value of the firm, V, is the underlying asset on which the options are written; the debt's promised principal, B, is the exercise price; and the debt's maturity date is the option's expiration date. But since the value of the firm is the sum of the value of the equity and the value of the debt,

$$V = E + D,$$

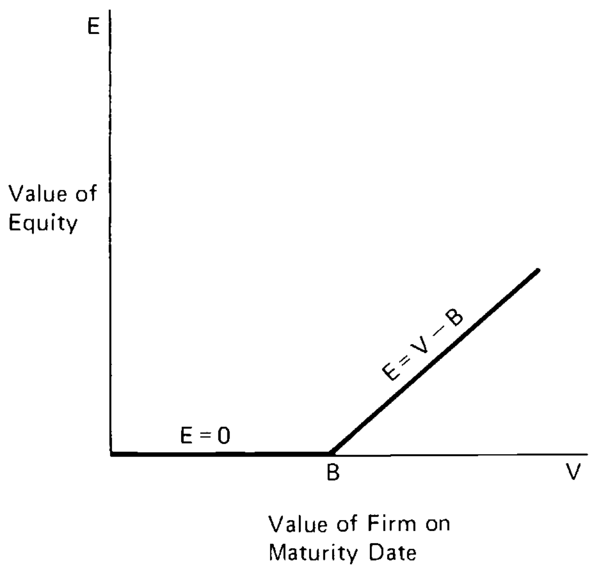

Fig. 5.5 Payoff to equity

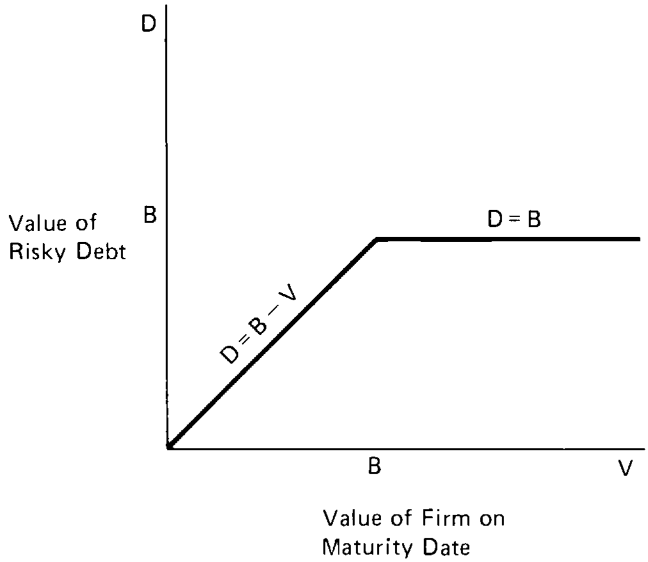

Fig. 5.6 Payoff to debt

and since the value of the equity is analogous to a call option written on the value of the firm, it then follows that

$$D = B(1 + r)^{-T} - p. \tag{2}$$

The value of risky debt is equal to the price of a risk-free bond with the same terms minus the price of a put written on the value of the firm.

Expression (2) has an intuitive interpretation. It is commonly understood that risky debt plus a loan guarantee has the same value as risk-free debt. The loan guarantee is like insurance, that is, it will pay any shortfall in the value of the firm necessary to fully repay the debt. Figure 5.7 depicts the value of a loan guarantee, G, on the maturity date of the risky debt. If on the maturity date of the debt the value of the firm is greater than the debt's promised principal, that is, $V > B$, then the guarantee will pay nothing since the firm is sufficiently valuable to retire the debt. However, if the value of the firm is less than the promised principal, $V < B$, then the guarantor must pay the difference between the promised principal and the value of the firm, $B - V$, in order that the debt be fully repaid. Now compare figures 5.2 and 5.7. It is evident that a loan guarantee is analogous to a European put option written on the value of the firm, that is, $G = p$. And, therefore, expression (2) is simply the statement that risky debt plus a loan guarantee is equal to a risk-free bond.

The characterization of corporate liabilities as options goes much deeper than the simple corporate securities studied so far. For example, assume

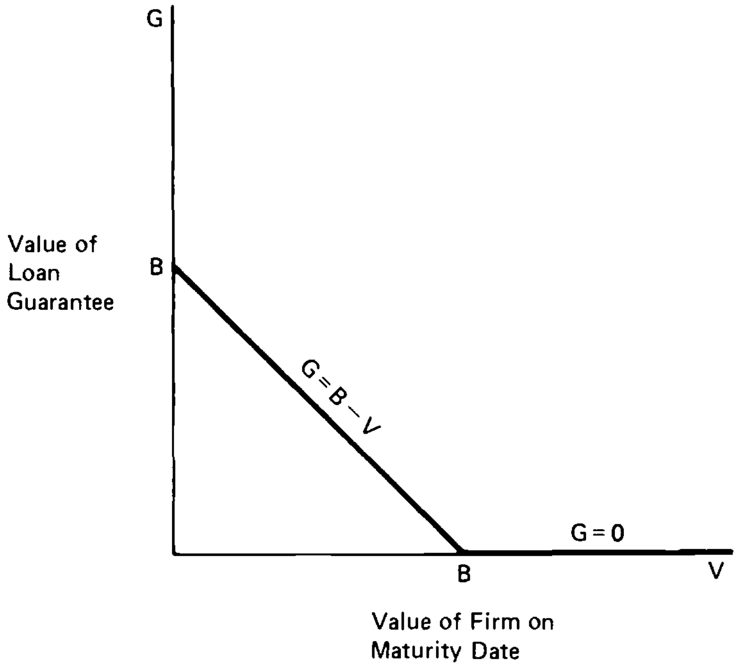

Fig. 5.7 Payoff from guaranty

that the debt receives coupon payments. Then equity can be thought of as analogous to a European call option on a dividend-paying stock where the coupon payments are the "dividends." Now assume the coupon bond is callable under a schedule of prices. The equity is now analogous to an American call option on a dividend-paying stock where the exercise price changes according to the specified schedule. Furthermore, the value of the call provision can be characterized as the difference between the value of an American and a European call option where the exercise price changes according to the specified schedule. The value of call protection against redemption for the first $T_1 < T$ time periods can be viewed as the difference between the values of two American call options on a dividend-paying stock where the first call can be exercised at any time according to a schedule and the second call can only be exercised in the last $T - T_1$ time periods. As is evident from these examples, the correspondence between corporate liabilities and options extends to a wide variety of securities and covenants.

As shown, equity, zero-coupon debt, and loan guarantees can be represented as combinations of simple option contracts. The correspondence is, moreover, sufficiently complete that it is possible to characterize many of the complex securities and covenants encountered in practice by similar analogies to basic options. Note that this correspondence is not dependent upon any particular option pricing model, but instead is a fundamental relationship which must hold independently of how options and corporate securities are assumed to be priced. Therefore, given any option pricing model with all its direct implications for pricing stock options, that same model has corresponding direct implications for the pricing of corporate liabilities and covenants.

The traditional approach to the pricing of different corporate liabilities and covenants employs different valuation techniques and rules of thumb for different problems, and rarely attempts to integrate the various components of the firm's capital structure as even a check on the internal consistency of these diverse valuation methodologies. In contrast, the CCA approach to the pricing of corporate liabilities and covenants begins with the firm's total capital structure and uses a single evaluation technique to price each of the individual components of that structure simultaneously. Thus, the CCA methodology takes into account the interactive effects of each of the securities on the prices of all the others and ensures a consistent evaluation procedure for the entire capital structure.

5.3 Call Provisions and Call Protection

JMR (1984, 1985) test the ability of a CCA model based on the option pricing principles of Black and Scholes (1973) to predict the prices of multiple issues of callable coupon debt subject to sinking funds. The test not only accounted for all the debt covenants present but also recognized the interactions among the different issues in multiple bond capital structures. Data were collected for 27 firms on a monthly basis from January 1975 through January 1981 when possible. The firms were selected according to a number of criteria at the beginning of 1975: (1) simple capital structure (i.e., one class of stock, no convertible bonds, small number of debt issues, no preferred stock); (2) small proportion of private debt to total capital; (3) small proportion of short-term notes payable or capitalized leases to total capital; and (4) all publicly traded debt is rated.

Based on these criteria the following firms were selected:

Firm	Bond Rating Range	Firm	Bond Rating Range
Allied Chemical	AA/A	Cities Service	A
Anheuser Busch	A	CPC	AA/A
Braniff	BBB/CC	Crane	BBB
Brown Group	A	Food Fair	BB/B
Bucyrus Erie	A	Fuqua	B
Champion Spark Plug	AA	General Cigar	BB/B
		Kane Miller	B

Firm	Bond Rating Range	Firm	Bond Rating Range
MGM	BBB/B	Republic Steel	A
National Tea	B	Seagram	A
NVF	B	Sunbeam	A
Proctor & Gamble	AAA	Tandy	BBB/BB
Pullman	BBB	United Brands	B
Rapid American	B/CCC	Upjohn	AA
Raytheon	AA/A	Whittaker	BB/B

CCA requires three kinds of data to solve for prices of individual claims as functions of total firm value: (1) indenture data, (2) business risk data, and (3) interest rate data. For example, the following data were collected for each bond for each firm: principal, coupon rate, call price schedule, call protection period, sinking fund payments, seniority, and options to sink at market or par. The bond covenant data were collected from Moody's Bond Guide, except that sinking fund payments were collected from the monthly S&P Bond Guide. For purposes of testing the model, actual bond prices were also collected from the latter source. Business risk was estimated by measuring the volatility of the firm's equity returns and adjusting these estimates in a manner consistent with the CCA model and the observed leverage of the firm. Lastly, it was assumed that the future course of the 1-year rate of interest is known and is consistent with the 1-year forward interest rates implied by the current term structure.

Tables 5.1–5.3 summarize the results. Percentage error is defined as the predicted price minus the actual price divided by the actual price. Absolute percentage errors and results from a naive model are also reported. The naive model essentially assumes that the value of the firm is suffi-

Table 5.1 **Pricing Results and Comparisons: CCA Model and Naive (Riskless) Model (Standard Deviations in Parentheses)**

		Mean Percentage Error		Mean Absolute Percentage Error	
Overall Results	Number of Bonds	CCA Model	Naive Model	CCA Model	Naive Model
Entire sample	305	.0452 (.1003)	.0876 (.1441)	.0845 (.1705)	.1143 (.1240)
Investment grade	176	.0047 (.0727)	.0149 (.0703)	.0587 (.0432)	.0574 (.0432)
Noninvestment grade	129	.1005 (.1063)	.1867 (.1590)	.1197 (.0840)	.1919 (.1528)

Table 5.2 Individual Firm Results: CCA Model and Naive (Riskless) Model (Standard Deviations in Parentheses)

		Mean Percentage Deviation		Mean Absolute Percentage Error	
Firm	Number of Bonds	CCA Model	Naive Model	CCA Model	Naive Model
Allied Chemical	20	−.0180	−.0155	.0616	.0598
		(.0693)	(.0678)	(.0365)	(.0357)
Anheuser Busch	20	−.0138	−.0068	.0615	.0641
		(.0760)	(.0785)	(.0467)	(.0458)
Braniff	20	.0544	.1044	.0857	.1134
		(.0957)	(.1021)	(.0691)	(.0921)
Brown Group	11	.0331	.0336	.0507	.0511
		(.0510)	(.0511)	(.0335)	(.0336)
Bucyrus Erie	10	.0187	.0228	.0313	.0331
		(.0384)	(.0372)	(.0290)	(.0283)
Champion Spark Plug	5	−.0648	−.0630	.0762	.0755
		(.0578)	(.0584)	(.0416)	(.0412)
Cities Service	10	.0262	.0308	.0553	.0557
		(.0575)	(.0541)	(.0305)	(.0278)
CPC	10	.0015	.0017	.0463	.0469
		(.0561)	(.0565)	(.0316)	(.0316)
Crane	17	.0388	.0435	.0676	.0710
		(.0758)	(.0800)	(.0518)	(.0570)
Food Fair	4	.0840	.0983	.0840	.0983
		(.0759)	(.0891)	(.0759)	(.0891)
Fuqua	22	.1048	.1658	.1195	.1802
		(.0816)	(.0908)	(.0581)	(.0571)
General Cigar	5	.0162	.0258	.0786	.0731
		(.0970)	(.0937)	(.0592)	(.0641)
Kane Miller	5	.1099	.1411	.1099	.1411
		(.0366)	(.0419)	(.0366)	(.0419)
MGM	26	.0302	.0838	.0832	.0910
		(.0922)	(.0629)	(.0501)	(.0521)
National Tea	3	.0995	.1267	.0995	.1267
		(.0511)	(.0885)	(.0511)	(.0885)
NVF	6	.1436	.2481	.1436	.2481
		(.0886)	(.0915)	(.0886)	(.0915)
Procter & Gamble	15	−.0041	−.0037	−.0492	−.0500
		(.0584)	(.0605)	(.0318)	(.0343)
Pullman	4	−.0579	−.0544	.0617	.0605
		(.0414)	(.0412)	(.0355)	(.0315)
Rapid American	22	.1565	.3832	.1579	.3832
		(.1067)	(.2084)	(.1046)	(.2084)

Table 5.2 *(continued)*

Firm	Number of Bonds	Mean Percentage Deviation		Mean Absolute Percentage Error	
		CCA Model	Naive Model	CCA Model	Naive Model
Raytheon	5	.0245	.0231	.0824	.0805
		(.0962)	(.0959)	(.0555)	(.0571)
Republic Steel	10	−.0231	.0238	.0565	.0273
		(.0647)	(.0348)	(.0391)	(.0322)
Seagram	9	.0419	.0410	.0419	.0410
		(.0283)	(.0294)	(.0283)	(.0294)
Sunbeam	5	−.0653	−.0443	.0706	.0558
		(.0513)	(.0413)	(.0436)	(.0236)
Tandy	11	.0510	.0778	.0956	.0799
		(.0951)	(.0679)	(.0501)	(.0655)
United Brands	12	.1302	.2454	.1433	.2454
		(.1423)	(.1546)	(.1291)	(.1546)
Upjohn	3	.0139	.0138	.0268	.0271
		(.0258)	(.0261)	(.0119)	(.0117)
Whittaker	15	.1129	.1529	.1286	.1529
		(.0985)	(.0713)	(.0769)	(.0713)

ciently large to make all debt riskless. These results were obtained from the same runs of the model that produced the CCA estimates. Thus the naive model prices simply reflect the magnitude and timing of promised payments discounted back by the risk-free interest rates, plus the effects of the call provision and the sinking fund option to sink at the minimum of par or market. Incrementally, the CCA model prices attempt to capture the risk of default through the consideration of business risk and financial risk, that is, finite firm value relative to promised payouts. In addition, the CCA model introduces the distinction between senior and junior debt as well as the presence of equity which complicates (relative to the naive model) the optimal call policy.

Table 5.1 presents the pricing errors for the CCA and the naive model. Results are reported for investment-grade (bond rating of BBB or higher) and non-investment-grade subsamples as well as the entire sample. As is evident from inspection, the CCA and naive models are virtually indistinguishable for investment grade bonds. This can be interpreted as evidence that default risk is not playing a significant role in explaining investment-grade bond prices. This also suggests that a stochastic interest rate model could be a better predictor of investment-grade bond prices and therefore a better predictor of the value of call provisions and call protection. There

Table 5.3 Pricing Results and Comparisons by Year: CCA Model and Naive (Riskless) Model (Standard Deviations in Parentheses)

		Mean Percentage Error		Mean Absolute Percentage Error	
Year	Number of Bonds	CCA Model	Naive Model	CCA Model	Naive Model
1977:					
Entire sample	60	.0906	.1470	.0918	.1475
		(.0729)	(.1833)	(.0714)	(.1830)
Investment grade	36	.0664	.0719	.0672	.0726
		(.0522)	(.0524)	(.0513)	(.0514)
Non-investment grade	24	.1269	.2598	.1287	.2598
		(.0836)	(.2423)	(.0809)	(.2423)
1978:					
Entire Sample	59	.0502	.0789	.0733	.1008
		(.0825)	(.1302)	(.0628)	(.1141)
Investment grade	35	.0102	.0132	.0486	.0502
		(.0597)	(.0605)	(.0361)	(.0363)
Non-investment grade	24	.1085	.1747	.1094	.1747
		(.0761)	(.1445)	(.0748)	(.1445)
1979					
Entire sample	62	−.0075	.0530	.0705	.0970
		(.0934)	(.1248)	(.0617)	(.0947)
Investment grade	33	−.0357	−.0223	.0568	.0497
		(.0623)	(.0628)	(.0439)	(.0443)
Non-investment grade	29	.0245	.1387	.0861	.1508
		(.1109)	(.1225)	(.0741)	(.1073)
1980					
Entire sample	63	.0607	.0994	.0943	.1253
		(.1055)	(.1370)	(.0770)	(.1138)
Investment grade	35	.0065	.0159	.0559	.0534
		(.0671)	(.0643)	(.0376)	(.0391)
Non-investment grade	28	.1285	.2039	.1422	.2152
		(.1056)	(.1320)	(.0863)	(.1126)
1981:					
Entire sample	61	.0332	.0603	.0921	.1008
		(.1135)	(.1160)	(.0741)	(.0833)
Investor grade	37	−.0263	−.0067	.0641	.0599
		(.0723)	(.0713)	(.0426)	(.0392)
Non-investment grade	24	.1249	.1637	.1353	.1637
		(.1039)	(.0935)	(.0899)	(.0935)

Table 5.4 Value of Call Provision and Call Protection: Falling Term Structure

Interest Rate Volatility	Bond Description	Par Bond Coupon
Low	Noncallable	8.625
Low	Callable after 7 years @ 100	9.06
Low	Callable after 6 years @ 100	9.06
High	Noncallable	7.875
High	Callable after 7 years @ 100	8.75
High	Callable after 6 years @ 100	9.10

do appear to be significant differences between the CCA and naive models for non-investment-grade bonds where default risk is undoubtedly playing a large role.[2]

Tables 5.2 and 5.3, which present the results by firm and year, respectively, suggest that the valuation errors could be firm and year specific. A firm effect could be induced by a specific bond effect, that is, the fact that a specific bond is underpriced in one year increases the probability it will be underpriced in other years. A firm effect could also be induced by a systematic bias in the estimate of the business risk of the firm, that is, a systematic overestimate of business risk will lead to systematic underpricing of bonds for that firm. A year effect could be induced by the nonstochastic interest rate assumption. Table 5.3 suggests that the year effect is stronger for investment grade bonds, which is consistent with viewing interest rates as the major source of uncertainty for this set of bonds. Lastly, this test of the CCA model assumed symmetric tax treatment for corporate bonds which undoubtedly explains the model's tendency to undervalue discount bonds.

One of the reasons the CCA model tested by JMR (1984) does not do a better job of predicting callable debt prices is that the model uses the value of the firm as the source of volatility, that is, default risk. As practitioners well understand, it has been the increased volatility of interest rates, not firm value, which has contributed most substantially to the overall volatility of the market. It is possible to recast the CCA model, following Cox et al. (1984), such that the source of uncertainty driving the value of such common debt covenants as call provision and call protection is interest rate risk, not default risk. Tables 5.4 and 5.5 present some CCA numeric re-

2. See Jones et al. (1984, 1985) for a more complete treatment of the differences between the CCA and naive models.

Table 5.5 Value of Call Provision and Call Protection: Rising Term Structure

Interest Rate Volatility	Bond Description	Par Bond Coupon
Low	Noncallable	11.50
Low	Callable after 7 years @ 100	11.50
Low	Callable after 6 years @ 100	11.50
High	Noncallable	10.31
High	Callable after 7 years @ 100	10.93
High	Callable after 6 years @ 100	11.25

sults for the value of a call provision and call protection on a risk-free bond in both a rising and a falling term structure environment. In each case it is assumed that the short-term interest rate is 10% and the bond's maturity is 10 years. In table 5.4 the term structure is assumed to be falling, with long rates at the 6% level. When interest rates have low volatility, the CCA model computes the coupon on the 10-year par bond at 8.625%. The value of the particular call provision considered, callable after 7 years at 100, is computed at 43.5 basis points (906 – 862.5). One less year of call protection is shown to have no value. When interest rates have high volatility, the CCA model computes the coupon on the 10-year bond as 7.875% and the value of the call provision as 87.5 basis points. One less year of call protection is calculated as having the value of 35 additional basis points.

Table 5.5 shows the same calculations when the term structure is rising, that is, long rates at the 15% level and the short rate at 10%. Here, logically enough, the value of the call provision and call protection is less given the upward-sloping term structure. In fact, for low volatility, the CCA model shows these provisions to have no value. In the high-volatility case, while there is some reduction in value due to the rising term structure, it is not significant. The value of the call provisions is 62 basis points and the value of one more year of call protection is 32 basis points. This underscores the relative importance of volatility versus the shape of the term structure, that is, expectations, in valuing call provisions and call protection.

5.4 Conclusion

Increased capital market volatility has increased the value of any financial flexibility built into the design of securities. The options-based CCA approach to valuing financial flexibility holds forth the potential of not only valuing a wide range of covenants but also accounting for the interaction of various securities and covenants within a capital structure. As is evident from the empirical work of JMR (1984, 1985) the application of CCA to complex capital structures is still in the development stages. However, CCA techniques are being used to help value individual covenants as demonstrated with the reported numeric analysis of call provisions and call protection. In addition, CCA is being used to value such new forms of financial flexibility as debt with warrants to purchase additional debt, puttable debt, and extendable debt. Various forms of equity-linked debt, for example, convertible debt, units of debt with warrants, exchangeable debt, and exchangeable units of debt with warrants, are also being valued using CCA techniques. While CCA is more complex than traditional valuation techniques, it more correctly incorporates the interactions of multiple securities and covenants and the role of volatility in the valuation of financial flexibility. As markets become more volatile and securities more complex, interest in correctly valuing financial flexibility should also increase.

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