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HOW RISKY IS THE DEBT IN HIGHLY LEVERAGED TRANSACTIONS?
EVIDENCE FROM PUBLIC RECAPITALIZATIONS

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ABSTRACT

This paper presents estimates of the systematic risk of the debt in public
leveraged recapitalizations. We calculate the systematic risk of the debt as a
function of the difference between the systematic equity risk before and after
the recapitalization. The increase in equity risk is surprisingly small after
a recapitalization, ranging from 28% to 52% depending on the estimation method.
Under the assumption that total company risk is unchanged, the implied
systematic risk of the post-recapitalization debt in twelve transactions
averages 0.67. Under the alternative assumption that the entire market-
adjusted premium in the leveraged recapitalization represents a reduction in
fixed costs, the implied systematic risk of this debt averages 0.42.

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1. Introduction

The number and magnitude of highly leveraged transactions such as leveraged buyouts (LBOs) and leveraged recapitalizations have grown explosively in the last several years. These transactions are largely financed with a combination of senior bank debt and subordinated lower grade or "junk" debt. Recently, the debt in these transactions has come under increasing scrutiny from investors, politicians and academics. All three groups have asked a version of the question of how risky leveraged buyout debt is relative to the return it provides. One of the primary issues in Congressional hearings in early 1989 concerned the banking sector's ability to withstand a recession in the face of large LBO loans.[1] Similarly, the troubles in the lower grade bond market in the fall of 1989 (precipitated by the Campeau transaction) magnified investor's concerns about the riskiness of high yield bonds.[2]

Little academic research focuses exclusively on the risk / return characteristics of debt in highly leveraged transactions. Several recent studies, however, examine the lower grade public bond market in some detail. These studies incorporate data from highly leveraged transactions as well as from other issuers who used lower grade bonds to finance normal operations. Asquith, Mullins and Wolff (1989), and Altman (1989) examine the ex-post default experience of lower grade bonds issued between 1977 and 1986. They find high cumulative default rates (over 30% for bonds outstanding ten years or more) relative to those for investment grade bonds. In a recent paper, Blume and Keim (1989) incorporate actual bond default experience to calculate the returns that an investor would have realized by buying all the newly issued lower-grade bonds in 1977 and 1978. They find that the realized return on these bonds is 8.52%, approximately 1% above the return on an investment in Treasury bonds during the same time period.[3] As Asquith et al point out, however, historical results represent only one draw from the distribution of possible lower grade bond returns. Realized returns, ex post, may be abnormally high or

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[1] See the testimony of Alan Greenspan on Leveraged Buyouts and Corporate Debt to the Committee on Finance, United States Senate, January 26, 1989.

[2] See, for example, "The Party's Over: Mounting Losses are Watershed for Junk-Bond Market," Wall Street Journal, September, 18, 1989, p.1.

[3] Asquith et al report a 115 basis point spread based on simulations of their data set.

low even if expected returns, ex ante, were normal.

Asquith et al also point out that default risk is only one type of risk for which investors must be compensated. Returns to investments in lower grade bonds (like any other security) also should compensate the investor for ex ante, systematic market risk. In this vein, Blume, Keim and Patel (1989) present direct estimates of realized returns and systematic market risk from lower grade bond prices. They find that returns on lower grade bonds have a beta of 0.25 relative to returns on the S & P 500 between 1982 and 1987, and 0.20 between 1985 and 1987. They also obtain virtually identical results using the returns on a portfolio of small stocks. During this time period, the standard deviation of the returns on a portfolio of high yield bonds is lower than the standard deviation on a portfolio of Treasury Bonds, the S&P 500, and a portfolio of small stocks.

However, the junk bond market is relatively illiquid.[4] Consequently, the quoted prices used by Blume, Keim and Patel (1989) may not measure the true market prices. Estimates of systematic risk made from the quoted prices would be downward biased if quoted prices are "sticky" and do not adjust fully and immediately to changes in "true" market values. Cornell and Green (1989) try to avoid this problem by using the returns on open end lower grade bond mutual funds. They find a higher beta (using the S&P 500), equal to 0.36, for an equally-weighted portfolio of lower grade bond funds from 1977 to 1988.[5]

In this paper, we take a new approach to the question of debt pricing in highly leveraged transactions. As do Blume, Keim and Patel (1989) and Cornell and Green (1989), we focus on the systematic riskiness of debt returns. However, rather than trying to estimate debt riskiness directly, we use an "implicit" technique in which we calculate the debt beta as a function of the difference between

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[4] See, for example, "Overstated Value in 'Junk' Funds," New York Times, November 2, 1989, p.28.

[5] While this approach should provide better beta estimates, it is not clear how much better such estimates will be. As Cornell and Green are careful to note, net asset values, themselves, are calculated to some extent using dealer quotes. In addition, Cornell and Green cannot measure whether the bond funds are fully invested in bonds with rating lower than Baa by Moody's or BBB by Standard and Poor's. To qualify as a lower grade mutual fund in the Cornell and Green paper, a fund need only have two-thirds of its portfolio invested in bonds rated Baa or BBB or lower.

the systematic equity risk before and after the recapitalization. Our use of this technique is motivated by two factors: first, concerns about the quality of bond price data and the corresponding potential for problems when directly estimating the betas of lower grade bonds; and second, the importance of bank debt in highly leveraged transactions. It is not possible to estimate betas for bank debt directly because price data do not exist.[6] As we discuss below, our approach can shed some light on the question of bank debt riskiness.

Our methodology relies on data from public leveraged recapitalizations. Unlike a typical LBO, a public recapitalization does not involve the repurchase of all of a company's stock. Although there is a dramatic increase in leverage, public stockholders retain some ongoing interest in the company -- they receive a large one-time dividend, but also keep their shares. These shares continue to trade, albeit at a reduced price that reflects the dividend payout. Recaps are often employed as defensive maneuvers by companies under takeover pressure, and result in a financial structure quite similar to that seen after an LBO. For our purposes, the key distinction is the existence of stock price data after the completion of the deal.

Our methodology is most easily explained through the use of a stylized example. Imagine that XYZ Corp. is initially all equity financed, and has a market value of $100 and an equity beta of 1. Now suppose that XYZ undertakes a recap, borrowing $85 from bank and lower grade bond lenders, and using the cash to pay an $85 dividend to shareholders. If there are no taxes or other sources of gains, the total market value of the company must still be $100. Thus the "stub" equity component is worth $15. If the post-recapitalization debt has no systematic risk, then conservation of systematic risk implies that the stub equity should have a new beta of $1/.15 = 6.67$. Suppose, however, that we measure the stub's beta and find it to be only 2.22. This must mean that two-thirds of the total company risk is now borne by the debtholders, so that the debt has an "implied beta" of $.67/.85 = .78$.

We first calculate the systematic risk of pre- and post-recapitalization equity (using the market

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[6] A secondary market for highly leveraged bank loans has developed recently. However, we are unaware of any publicly available high quality pricing data that could be used for direct estimates.

model and the value-weighted market index). We find that the average equity beta rises a surprisingly modest amount after a recapitalization. Market model estimates using daily returns rise from an average of 1.01 before to 1.29 after the recapitalization. The increase is larger, but still surprisingly small for Scholes-Williams estimates on daily returns (from 1.00 to 1.52) and for market model estimates on weekly returns (from 1.04 to 1.44). These estimates of equity risk provide the basis for our subsequent implicit estimates of debt betas. Because the increases in equity betas are small considering the amount of debt added in the recapitalizations, our methodology produces relatively high debt betas.

In our first scenario, we assume that the systematic risk of a firm's total capital - its asset beta - is unchanged after a recapitalization. Under this assumption, we find that the implied systematic risk on the debt in 12 leveraged recap transactions averages 0.67 (with a standard error of 0.06). This is the average beta for all debt, both senior and junior. Our methodology cannot determine the allocation of systematic risk between senior and junior debt. Under the arbitrary assumption that the junior, lower grade debt has twice the systematic risk of the senior, bank debt in these transactions, we find that the lower grade debt has an average beta of 0.93.

Next, we consider a second principal case in which we assume the entire (market-adjusted) premium in the leveraged recapitalization represents a reduction in fixed costs. This is equivalent to assuming that firms undergoing leveraged recapitalizations experience a large decrease in their asset betas. Under this assumption, we find the implied systematic risk of total debt averages 0.42 (with a standard error of 0.05). Our estimate for the lower grade debt (assuming lower grade debt has twice the systematic risk of bank debt) is 0.57.

The differences between the constant and reduced asset beta cases illustrate that the debt beta results depend on the assumptions about changes in asset beta after a recapitalization - a subject we discuss in detail in Section 3. We do not attempt to make a case for a single "best" estimate of debt betas. Given the uncertainties that inevitably surround our indirect approach, our goal is simply to establish a reasonable range of values, and to highlight the assumptions upon which the different values are based.

The implied beta estimates in our constant asset and reduced asset beta cases are based on the equity betas estimated using the market model on daily returns to a value-weighted index. We obtain similar results using Scholes-Williams equity betas and equity betas estimated using the market model on weekly returns to a value-weighted index. We also obtain similar results using equal-weighted index returns and S&P 500 returns.

After presenting our implied beta estimates, we contrast them with direct estimates of the systematic risk of the low grade bonds in these transactions using bond price data provided by Morgan Stanley. Depending on the estimation technique, we find that these low grade bonds have an average beta of at most 0.41. This is in line with the results of Cornell and Green and at the low end of the range of values suggested by our implied beta methodology.

The paper proceeds as follows. Section 2 describes our sample. Section 3 describes our methodology. Section 4 presents our implied systematic risk estimates. Section 5 presents our direct estimates of the systematic risk of high yield bonds. Section 6 offers concluding comments.

2. Sample

We identify leveraged recapitalizations as those companies categorized as completed recapitalizations by the Securities Data Company merger database in July, 1989 and as those companies which comprise the Salomon Brothers Stub Index. The companies in the Salomon Brothers Stub Index "have all undertaken leveraged recapitalizations or buyouts that have raised debt outstanding above the historical level and caused the firm's creditworthiness to fall."[7] We begin with 31 companies from these two sources. However, our tests require that we restrict the sample in several ways.

We exclude three companies that were not publicly traded after the recapitalization. We also exclude one company because it did not have publicly traded equity prior to the recapitalization. To ensure a sufficient number of stock returns with which to compute β's, we exclude nine companies which

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[7] See "Stubs: Should Investors Care?" by R.S. Salomon, Jr. and Eric Sorenson, Stock Research, Investment Policy, Salomon Brothers, July 13, 1989.

completed their recapitalizations in 1989.[8]   Finally, to obtain a sample of highly leveraged companies with characteristics similar to leveraged buyouts, we exclude six companies with less than 60% debt in their capital structure just after the recapitalization is consummated.

The twelve companies which satisfied our data requirements and the dates the recapitalizations were completed are listed in Table 1. For each company, we obtained the proxy statement or 10-K statement which described the recapitalization transaction. We also obtained pre- and post-transaction financial statements for these companies. With these documents, we determined the pre- and post-recapitalization capital structures. Table 1 shows that these companies are not highly leveraged before the recapitalization. Debt in the average company is 25.5% of total capital.

Table 2 confirms that public shareholders receive large premiums in leveraged recapitalization transactions. On average the common stock prices of recapitalization companies increase 57.0% from 40 trading days before the recapitalization announcement until the recapitalization is completed. This increase is 44.9% greater than the increase in the value-weighted index over the same time period.

Tables 1 and 2 show that the sample companies become highly leveraged after the recapitalizations. Debt makes up 81.3% of post-recapitalization total capital on average, where post-recapitalization total capital is the sum of the market value of equity the day the recapitalization is completed, the book value of preferred stock and the book value of both convertible and non-convertible debt.[9] This degree of leverage is only slightly less than the 85.6% found for a sample of management buyouts by Kaplan (1989b). Thus the recapitalizations appear to be representative of buyout financial structures.

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[8] Of these nine, only two or three will meet the other requirements when more returns are available.

[9] This measure of total capital should approximate market value. The book value of newly issued debt and preferred stock will equal market value just after the recapitalization is completed. (All newly issued discount debt is booked at its market value, not face value.) In addition, no old convertible debt remains outstanding after the recapitalization. Only the relatively small amount of previously issued non-convertible debt may have a market value appreciably different from book value.

Table 2 shows that an average of 58.6% of post-recapitalization debt is newly provided by commercial banks while 25.2% is newly provided by lower grade subordinated debt. The remaining 16.2% of the post-recapitalization debt is pre-recapitalization debt that remains outstanding. In all cases, the bank debt carries a variable interest rate that is priced at a spread above the prime rate and/or LIBOR (London Interbank Offer Rate). Typically, the borrower has the option to pay the lowest of the rates available. For the 12 transactions in our sample, the average spreads are 1.48% over prime and 2.46% over LIBOR. In 1986 and 1987, the prime rate and LIBOR averaged 2.00% and 0.80%, respectively, above the six month T-Bill rates.[10] This implies that the LIBOR interest was the relevant rate during this time period. The average bank loan, therefore, required an interest rate approximately 3.25% over the T-Bill rate. Table 2 also shows that the lower grade debt in these transactions promised a yield to maturity an average of 5.01% above the yield on a Treasury Bond of comparable maturity. Because of default risk, expected returns above Treasuries are undoubtedly lower than the promised returns.

Overall, the capital structure, the premium paid to public shareholders and the interest rates on the debt financing in the 12 leveraged recapitalizations are similar to those found in management buyouts in Kaplan (1989b).

3.   Methodology

3.1   Constant Asset Beta Case

We take the following steps to estimate the implied betas or systematic risk of the debt in the leveraged recapitalizations. First, we estimate pre- and post-recapitalization equity betas, β^E_o (where the subscript "o" denotes "old") and β^E_n (where the subscript "n" denotes new), using the market-model:

$$(1) \quad R_{i,t} = \alpha_o + \beta^E_{o,i} * R_{m,t} + \epsilon_t \quad ; \text{ and}$$

$$(2) \quad R_{i,t} = \alpha_n + \beta^E_{n,i} * R_{m,t} + \epsilon_t$$

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[10] Yields are obtained from Salomon Brothers Analytical Bond Record.

where $R_{i,t}$ is the return to firm i over period t, $R_{m,t}$ is the return to the market portfolio over period t. In both of our principal cases, β^E_o is estimated by regressing daily stock returns on the CRSP value-weighted index from 165 trading days to 40 trading days before the recapitalization announcement; β^E_n is estimated by regressing daily stock returns on the value-weighted index from 3 trading days to 128 trading days after the recapitalization is completed.[11] These six month periods represent, respectively, from eight to two months before any information about the recapitalization is known and six months after the recapitalization is completed. In the 7 cases where a takeover bid or a large block share purchase by a hostile investor preceded the recapitalization announcement, the date of the bid or block purchase is considered the announcement date.[12] (Post-recapitalization betas are estimated after the recapitalization is completed.)

Using our estimates of β^E_o, we calculate pre-recapitalization asset betas, β^A_o:

$$(3) \qquad \beta^A_o \quad = \quad \beta^E_o \; \frac{E_o}{E_o + D_o} \; + \; \beta^D_o \; \frac{D_o}{E_o + D_o}$$

where E_o is the market value of equity using primary shares 40 trading days before the recapitalization announcement plus the book value of preferred stock and convertible debt, and D_o is the book value of non-convertible debt less excess cash. Excess cash is defined as the cash on hand used to finance the transaction.

Only two companies have pre-recapitalization convertible debt. (None have any convertible debt after the recapitalization.) During the estimation period before the recapitalization, the stock price exceeded the conversion price for one company and approximately equalled the conversion price for the other. The convertible debt, therefore, had significant equity characteristics. To the extent that the

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[11] In estimating betas, we do not use returns between October 11 and October 30, 1987 in order to exclude the potentially large and unreliable returns during the stock market crash of 1987. This does not affect the results. More generally, our results are also robust to different estimation intervals for equity betas.

[12] Only Colt, FMC, Holiday, Shoney's and Swank announced the recapitalizations before other bids or block purchases.

convertibles are not entirely equity, treating them as such would overstate β^A_o and, hence, overstate the estimated post-recapitalization debt betas. However, treating pre-recapitalization convertible debt as debt leads to virtually identical results.

To calculate the pre-recapitalization asset betas, we need to make an assumption about the beta of the old debt, β^D_o. In our principal cases, we assume β^D_o equals 0.15, which is approximately equal to the beta on Treasury Bonds over our sample period.[13] To the extent that a β^D_o of 0.15 is too high, our estimates of post-recapitalization debt betas will be overstated. Below, we also present the polar case where β^D_o equals 0.0.

In our "constant asset beta case", we assume that company asset betas are the same before and after the recapitalization. This implies:

$$(4) \qquad \beta^A_o \quad = \quad \beta^E_n * \frac{E_n}{E_n + D_n} \quad + \quad \beta^D_n * \frac{D_n}{E_n + D_n}$$

where β^D_n is the beta or systematic risk of all debt, E_n is the market value of equity using primary shares after the recapitalization is completed plus the book value of preferred stock and D_n is the book value of debt after the recapitalization is completed. This calculation does not adjust for any tax shields associated with debt.

In our calculations, we treat preferred stock as equity. This understates estimated debt betas because non-convertible preferred stock has some debt characteristics and the sample companies have more preferred stock after the recapitalization than before. Below, we also present estimates in which we treat preferred stock as debt.

Rearranging terms, we calculate an implied debt beta:

$$(5) \qquad \beta^D_n \quad = \quad \frac{[E_n + D_n]}{D_n} [\beta^A_o - \beta^E_n * \frac{E_n}{E_n + D_n}]$$

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[13] See Blume, Keim and Patel who estimate that Treasury bonds have betas of 0.24 over the period 1982 to 1988, and 0.16 from July, 1985 to the end of 1988.

3.2   Reduced Asset Beta Case

Firms' asset betas may not be equal before and after a recapitalization. Healy and Palepu (1990) find that companies experience an increase in asset betas after a primary issue of common stock. The large repurchase of common stock in a leveraged recapitalization could be associated with the opposite kind of news about company risk. Furthermore, the results in Kaplan (1989a and 1989b) and Schipper and Smith (1988) suggest that companies undergoing management buyouts realize significant reductions in operating costs and taxes. To the extent that these primarily represent reductions in fixed obligations, asset betas will decline. (In contrast, reductions in variable costs only, leaving fixed costs constant, will increase asset betas.)

To account for a possible reduction in asset beta, we consider a "reduced asset beta case" in which the entire market-adjusted premium from the recapitalization represents a reduction in fixed costs. This is equivalent to assuming:

$$(6) \quad \beta^{A\bullet}_{o} \quad = \quad \beta^{A}_{o} * (E_o + D_o + Mkt_o) / (E_n + D_n)$$

where $\beta^{A\bullet}_{o}$ is the new (reduced) asset beta and Mkt_o is the market adjustment. Mkt_o is the product of E_o and the return on the value-weighted index from 40 days before the recapitalization announcement up to the recapitalization completion.

The implicit beta on all post-recapitalization debt, $\beta^{D\bullet}_{n}$, is then calculated as:

$$(5\bullet) \quad \beta^{D\bullet}_{n} \quad = \quad \frac{[E_n + D_n]}{D_n} [\beta^{A\bullet}_{o} - \beta^{E}_{n} * \frac{E_n}{E_n + D_n}]$$

These estimates of post recapitalization debt betas are similar to, but lower than those that would be

obtained using a tax adjusted formula when tax benefits are riskless and permanent.[14]

The constant and reduced asset beta cases cover a wide range of possible post-recapitalization operating changes. However, as a matter of pure theory, post-recapitalization asset betas could end up on either side of these bounds. For example, a company that recapitalizes might realize reductions in fixed costs that are worth more than the premium, but incur increased variable costs. Alternatively, the operating improvements might alter fixed and variable costs in such a way that a company's operating leverage, and therefore, its asset beta increase. Nonetheless, we believe the constant and reduced asset beta cases establish a plausible range of values for post-recapitalization asset betas.

If anything, the reduced asset beta case goes too far in reducing asset betas and the corresponding implied debt betas. While managers clearly have an incentive to reduce costs in their highly leveraged companies, it seems likely that a portion of the typical premium represents a reduction in variable costs. First, the ability to use tax benefits depends on the amount of taxable income which clearly has a variable or systematic component. Second, while some operating improvements undoubtedly involve the reduction of fixed costs such as headquarter employees, others such as improved inventory management, generate gains which will vary with the scale of operations. Third, changes in the pattern of investment expenditures may actually increase systematic risk after the recapitalization. (Kaplan (1989b) finds that management buyouts reduce capital expenditures after the buyout.) For example, suppose companies are subject to agency problems of free cash flow and are overinvesting before the recapitalization (see Jensen (1986 and 1988)). Presumably, overinvestment is greater in good

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[14] The tax adjusted formula for β^D_n is:

$$\frac{[E_n + D_n * (1-\tau)]}{D_n} * [\frac{\beta^E_o * E_o + \beta^D_o * D_o}{E_o + D_o * (1-\tau)} - \frac{\beta^E_n * E_n}{E_n + D_n * (1-\tau)}]$$

This implicitly assumes tax benefits, at a rate τ, are certain and permanent. The tax benefits from both the new and old debt are incorporated, respectively, in the pre- and post-recapitalization equity values. If τ is sufficiently high - if riskless tax benefits alone explain most of the market-adjusted premium - this formula produces results similar to those obtained from equation (5•).

times when cash flow is more plentiful. To the extent that the increase in leverage after the recapitalization lowers the tendency to overinvest, it creates new value that has positive systematic risk. A similar argument can be made in the case where marginal investments have a positive rather than negative present value. Now the recapitalization, by forcing managers to forego valuable investments, reduces value. Since this underinvestment is likely to be more severe in bad times, the effect is, again, to increase systematic risk. Finally, to the degree that a recapitalization increases the expected costs of financial distress, there is an additional upward influence on post-recapitalization asset betas.

In light of these four considerations, we judge our constant and reduced asset beta cases to be plausible upper and lower bounds for estimating implied debt betas. Still, we recognize that since asset betas below those in our reduced asset beta case are at least a theoretical possibility, one might interpret the surprisingly low post-recapitalization equity betas we find primarily as evidence of a large reduction in asset beta. Accordingly, we also calculate the asset beta reduction that would have to take place if post-recapitalization debt betas are to remain at a level suggested by previous research.

3.3   Other Methodological Issues

Our constant and reduced asset beta estimates do not explicitly account for possible asset sales. For asset sales which are planned, but not completed, uncertainty about the sales price still exists and our methodology is appropriate.[15]   In the case of asset sales which are completed between the time of the recapitalization and the end of the post-recapitalization estimation period, our results may be affected. Given that the proceeds of the asset sales represent a now-certain source of value which can be used to pay down the debt, we should not be counting all the debt outstanding immediately after the recapitalization in our measure of D_n. Some of this debt is effectively "defeased" by the asset sale. We provide a check on this in what follows by looking at the amount of debt that is paid down in the year following the recapitalization. Our results are essentially unchanged. This is not surprising given the

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[15]   More precisely, this is correct insofar as the sales price has the same risk characteristics as the present value of the asset to the seller.

small magnitude of asset sales documented in Table 2 - only six of our twelve companies sell assets before the end of the estimation period. The average company sells assets worth 9.5% of total post-recapitalization capital with no single company selling assets worth more than 30% of total post-recapitalization capital.

Interest rate swaps and hedges on the bank debt used to finance the recapitalizations present an additional methodological concern. To the extent that companies enter into swaps and hedges, swap or hedge counterparties will bear some of the systematic risk we attribute to debt and equityholders. Although we cannot determine exactly how much systematic risk should be allocated to the swap or hedge counterparties, a quick calculation suggests that this allocation is small. In 10 of the 12 transactions, the bank loan agreement requires the company to swap or hedge at least 48% of the bank debt used to finance the transaction. At a minimum, this represents almost 30% of the post-recapitalization debt; at a maximum, 58.6% (all the bank debt). The amount of systematic risk in a swap, however, is likely to be small. Blume et al estimate betas for long-term Treasury bonds of 0.16 during this period; the swaps or hedges are of much shorter maturity - they do not exceed seven years - and, therefore, probably have a beta of at most 0.08. Taken together, these points suggest that controlling for swaps and hedges would reduce the implicit beta estimate for an individual company's debt by at most 0.05; the reduction in the average implicit debt beta would be smaller.

4. Empirical Results

4.1 Equity Betas

Table 3 presents our equity beta estimates using three different estimation methods (all with the value-weighted index). Panel A presents market model estimates using daily returns. We find that the recapitalization companies have an average equity beta of 1.01 (with a standard error of 0.06) and a median equity beta of 0.91 in the six-month period (125 trading days) before the recapitalization announcement. The post-recapitalization equity betas in the six months after recapitalization completion average 1.29 (with a standard error of 0.10) and have a median value of 1.25. The estimated post-

recapitalization equity betas are, thus, approximately 30% larger than the estimated pre-recapitalization equity betas. While significant at the 5% level, the increase is surprisingly low - the conventional unleveraging and releveraging procedure (that assumes all debt is riskless) implies that the average post-recapitalization equity beta should equal 4.25. In contrast, the highest equity beta in our sample is Owens Corning Fiberglas, at 1.86. In fact, the post-recapitalization equity betas of four of our sample companies decline. None of these four declines, however, is statistically different from zero at conventional significance levels.

It is possible that our beta estimates, particularly post-recapitalization, are affected by nonsynchronous trading biases.[16] To account for this possibility, panel B presents results based on the estimator suggested by Scholes-Williams (1977) again using daily returns while panel C presents market model estimates using weekly returns. The Scholes-Williams pre-recapitalization betas in panel B are similar in magnitude to the market model estimates with an average value of 1.00. The Scholes-Williams post-recapitalization equity betas are slightly higher than the market model estimates, averaging 1.52. For these estimates, only two companies have lower equity betas after the recapitalization than before. The weekly market model estimates in panel C appear to be an intermediate case between panels A and B. The pre-recapitalization equity betas average 1.04 (slightly higher than the previous estimates) and the post-recapitalization equity betas average 1.44.[17]

In Tables 4A, 4B and 5, we base our implied debt beta calculations on the market model estimates using daily returns. In Table 6, we show that the results for implied debt betas are similar when we use the equity betas obtained from the two other techniques. Throughout, the relatively high debt betas we calculate are a direct consequence of the fact that equity betas only rise modestly after a

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[16] The stock of all of the companies in our sample except for Swank traded every day before and after the recapitalization.

[17] John Hand very kindly provided independent verification of the market model and Scholes-Williams equity beta estimates. We also consulted Value Line to check our post-recapitalization estimates. Because of data requirements, Value Line only has such estimates for FMC, Multimedia and Owens Corning Fiberglas. However, the average Value Line beta is 1.41, approximately equal to our daily market model estimates of 1.39 for these three companies.

large increase in leverage.[18]

4.2   Implied Debt Betas: Constant Asset Beta Case

Table 4A presents our implicit debt betas under the assumption that pre- and post-recapitalization asset betas are equal. We begin by applying equation (3) to the pre-recapitalization equity beta estimates. This unleveraging procedure assumes that the pre-recapitalization debt has a beta of 0.15. Pre-recapitalization asset betas, are an average and median of 0.78 and 0.76, respectively. To unleverage the post-recapitalization equity beta estimates, we multiply them by (E_n / E_n + D_n). This product represents the portion of the post-recapitalization asset beta contributed by the post-recapitalization equity. The mean and median asset beta contributed by post-recapitalization equity are, respectively, 0.24 and 0.22.

The portion of asset beta contributed by post-recapitalization equity is small compared to the pre-recapitalization asset betas. Under the assumption that pre- and post-recapitalization asset betas are equal, we attribute the "missing" systematic risk to the post-recapitalization debt. Applying equation (5), we find average and median implicit beta on all post-recapitalization debt of 0.67 and 0.62, respectively. The average has a standard error of 0.06.[19] The beta estimates for debt are large relative to those found in previous work. If they are correct, they suggest that the value of debt in highly leveraged companies

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[18] Similarly, Baldwin and Mason (1983) find that Massey Ferguson, a company whose leverage increased dramatically over time due to poor performance, experienced a decline in its equity beta during the period of poor performance.

[19] The standard error of the average implicit beta is calculated as:

$$\left(\sum_{i=1}^{k} \text{Var} \left(\beta^{D}_{n,i} \right) / k^2 \right)^{.5}$$

where: $\text{Var} \left(\beta^{D}_{n,i} \right)$ $= S^2_{old} + S^2_{new};$

S^2_{old} $= [E_o/(E_o + D_o)]^2 * [(E_n + D_n)/D_n)]^2 * S^2_{Eo};$

S^2_{new} $= S^2_{En} * (E_n / D_n)^2;$

S^2_{Eo} and S^2_{En} are the estimated variances of the pre- and post-recapitalization equity betas. k is the number of sample firms.

will vary substantially with the value of the stock market.

4.3   Implied Debt Betas: Reduced Asset Beta Case

Table 4B presents our results under the assumption that the market-adjusted premium paid to public shareholders to complete the recapitalization represents a reduction in fixed costs. If this is the case, the post-recapitalization asset beta is smaller than the pre-recapitalization asset beta. Table 4B begins with the same pre-recapitalization equity betas calculated for the constant asset beta case in Table 4A. As in the constant asset beta case, we calculate the asset beta of the pre-recapitalization company using equation (4). Then, we adjust the pre-recapitalization asset beta for a reduction in fixed costs by using equation (7). This adjusted asset beta averages 0.58 and has a median of 0.60, a decrease of approximately 25% from the constant asset beta case values. The calculations used to obtain post-recapitalization equity betas and asset betas from equity are the same as those for the constant asset beta case.

With the adjusted total asset beta and the portion of the asset beta contributed by post-recapitalization equity, we calculate the implicit beta on all debt using equation (5•). The average and median implicit betas are, respectively, 0.42 and 0.40. The average has a standard error of 0.05. Even in this reduced asset beta case, the estimates exceed those found by Blume, Keim and Patel (1989). In making this comparison, however, two points should be noted: (1) their estimates focus on all outstanding lower grade debt which may be less risky than the lower grade debt in highly leveraged transactions; and (2) our estimates, on the other hand, include a combination of bank and lower grade debt which should be less risky than the lower grade debt alone. We discuss the distinction between bank and lower grade debt risk in Section 4.6 below.

4.4   Implied Asset Betas Assuming Fixed Debt Betas

Asset betas, in theory, could be reduced below the levels assumed in Table 4B, and the low observed post-recapitalization equity betas could primarily be evidence of this reduced risk, rather than

of high debt betas. Table 5 turns equation (4) around, fixing β^D_n at 0.25, and calculating the implied post-recapitalization asset beta. A beta of 0.25 is roughly in line with the estimates by Blume, Keim and Patel (1989) for the sample period.

Table 5 shows that a β^D_n of 0.25 implies an average post-recapitalization asset beta of 0.42 (median of 0.44) down from 0.78 (0.76) before the recapitalization. The decrease in the average asset beta is 46%. Thus, under the assumption of debt riskiness compatible with previous research, our results imply that highly leveraged transactions are associated with very large reductions in asset betas.

4.5   Further Sensitivity Analysis

The constant and reduced asset beta cases provide two estimates of implicit betas on all debt in the recapitalizations in our sample. These estimates, however, rely on several other assumptions and estimation choices that may affect the results. Table 6 presents implicit betas on all debt under several alternative estimation methods and data choices.

Rows 1 and 2 replace the assumption that the pre-recapitalization debt has a systematic risk of 0.15 with an assumption that the systematic risk is 0.0 for the constant and reduced asset beta cases, respectively. This change reduces the average implicit beta on all debt to from 0.67 to 0.63 and from 0.42 to 0.39, respectively, in these cases. Using a beta of 0.0 on pre-recapitalization debt has a large effect on Fruehauf and Holiday because both companies have a relatively large amount of pre-recapitalization debt. In the constant asset beta case, their betas drop from 0.46 and 0.29, respectively, to 0.27 and 0.21. Thus, for these two companies, the assumption of β^D_o equal to 0.0 is particularly inappropriate.

Row 3 repeats the constant asset beta case, but treats preferred stock as debt rather than equity. This change has a moderate effect, increasing the average implicit debt beta to 0.72. In reality, preferred stock in these transactions is probably closer to debt than equity although it clearly has characteristics of both. This suggests that our decision to treat preferred stock as equity in the earlier analysis is somewhat conservative.

We use the value-weighted index for the majority of this paper because it gives a better measure of the total economy and the returns that all investors will earn. Nevertheless, it is possible that our results do not hold for the CRSP equal-weighted index or for the S&P 500. To check this, we present the implicit beta on all debt using returns on the equal-weighted index[20] in row 4 and using returns on the S&P 500 (without dividends) in row 5. The equal-weighted index returns lead to slightly higher implicit debt beta estimates (average of 0.81, median of 0.70), while the S&P 500 returns lead to slightly lower implicit debt beta estimates (average of 0.58, median of 0.56). These results suggest that the choice of index does not have a large effect on our implicit beta estimates.

The estimates in rows 6 and 7 use the alternative equity beta estimation techniques described in Section 4.1 (with returns on the value-weighted index). Using the Scholes-Williams (1977) estimates on daily data, the implied beta on all debt decreases moderately from 0.67 to 0.61. Using the market model estimates on weekly returns, the implicit beta on all debt averages 0.67, the same as the average using the market model estimates on daily returns. The results in rows 6 and 7 suggest that nonsynchronous trading does not have a large effect on our implicit beta estimates.[21]

Because stock prices vary, it is possible that the stock prices used to calculate the total market value of common stock in the leveraging formulas are not representative of stock prices during the estimation period. As a rough check on this possibility, row 8 presents estimates using stock prices eight months or 165 trading days before the recapitalization announcement (rather than 40 trading days before) and 128 trading days or six months after the recapitalization is completed (rather than 3 trading days after). This change causes a moderate decrease in the implicit beta from 0.67 to 0.62.

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[20] The estimates using the equal-weighted index are for 10 firms only. For two of our sample firms, equal weighted returns were not yet available over the period necessary to estimate equity betas.

[21] The fact that our results are robust to variations in beta estimation technique should not be surprising, given the small amount of equity that remains after the recapitalization. An alternative estimator would have to produce substantially higher post-recapitalization equity betas to have much influence on the implied debt betas.

Finally, as noted earlier, it is possible that the level of debt just after the recapitalization is temporary; asset sales and/or operating improvements can reduce debt quickly. If this is true, the debt outstanding just after the recapitalization is not representative of debt levels during the estimation period. The estimates in row 9 replace total debt when the recapitalization is completed with total debt level at the time of the first financial statement, when available, after the recapitalization. In the ten available cases, the first financial statement is dated after the end of the equity beta estimation period. The average implicit beta on all debt is unchanged from the 0.67 for the constant asset beta case.[22]

The alternative methods and assumptions for calculating the implicit beta on all post-recapitalization debt presented in Table 6 have relatively minor effects. Starting from the constant asset beta case assumption, none of these alternatives reduces the average estimated implicit beta on all debt to less than 0.58; none reduces the median implicit debt beta below 0.56. Overall, the results in Table 6 suggest that the most important unresolved issue in determining the implicit beta on all debt is the extent to which, if at all, the asset beta of the post-recapitalization company is lower than that of the pre-recapitalization company.

4.6   Division of Systematic Risk Between Bank and Lower Grade Debt

Our methodology does not allow us to measure the systematic risk of bank and lower grade debt separately. Thus far, we have presented our estimates of beta for all debt, both bank debt and lower grade debt, combined. It is likely, however, that the systematic risk of the bank debt in these transactions is lower than that of public lower grade bonds for several reasons. First, the bank debt has a claim that is senior to that of the lower grade debt. In periods of financial distress, the bank debt is likely to receive more than the lower grade debt. Second, the interest rate on the bank debt in 9 of the 12 transactions is contractually related (positively) to the financial strength of the company. The

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[22] It should be noted that the Row 9 estimate is for the beta on the debt still outstanding after the asset sale. To the extent that the asset sale was agreed to early in the estimation period, the average beta on all the debt outstanding at the time of the recapitalization would be somewhat lower. However, given the magnitude of the asset sales in our sample, this effect is small.

interest rate spread over the reference rate decreases when the company does well and increases when the company does badly. Third, the bank debt has a shorter maturity than the lower grade public debt. Because principal is returned sooner, the relative riskiness of bank debt is reduced further.[23]

While it is likely the bank debt has less systematic risk than the lower grade debt, it is impossible to know exactly how much less. In Table 7, we present estimates for the betas on bank debt and lower grade debt under three alternative assumptions. In the analysis, we classify all non-bank debt in the post-recapitalization company as lower grade debt. This overstates the amount of public lower grade debt outstanding for the post-recapitalization company and, thus, will understate the estimated beta on the lower grade debt. Panel A presents results for the constant asset beta case; panel B, for the reduced asset beta case.

The first two columns of panel A essentially repeat the results in Table 4A by assuming that the beta for bank debt and lower grade debt are the same. (The average betas for bank and lower grade debt differ slightly, however, because Swank has no public lower grade debt outstanding.) The estimates in the second two columns assume that the lower grade debt has twice the systematic risk of the bank debt. Under this assumption, the average implicit beta on lower grade debt is 0.93 while it is 0.46 for bank debt. The estimates in the final two columns of panel A make the assumption that the bank debt bears no systematic risk. In this case, the average beta on the lower grade debt is 1.64 which is (implausibly) greater than the calculated systematic risk of the equity. Put another way, the constant asset beta case estimates imply that bank debt must bear systematic risk. Because bank debt has a floating interest rate, this systematic risk must reflect credit risk, not interest rate risk.

Overall, the results in panel A suggest that lower grade bonds in these highly leveraged transactions bear a large amount of systematic risk relative to that found in previous studies of lower

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[23] It has been suggested that the bank loans may be more risky because they are subject to fraudulent conveyance claims on the theory that bank lenders made secured loans knowing that the firm was insolvent. We do not yet know how such claims will turn out. More generally, bankruptcy proceedings give rise to a number of complex legal issues that have as yet unclear implications for the division of value between senior and junior creditors in highly leveraged transactions.

grade bonds. The results also suggest that the loans made by commercial banks to highly leveraged transactions also bear a reasonable amount and, possibly, a great deal of systematic risk.

The second two columns of panel B show that in the reduced asset beta case, the assumption that the lower grade debt has twice the systematic risk of the bank debt leads to a lower grade debt beta of 0.57. Even in this case, the value of 0.57 is somewhat larger than the 0.36 found by Cornell and Green (1989) for lower grade bonds. The estimates in the final two columns of panel B make the assumption that the bank debt bears no systematic risk. This places a systematic risk of 1.00 on the lower grade debt. Unlike the estimates for the constant asset beta case, this assumption yields an average beta estimate on the lower grade debt that is lower than the average equity beta estimate.

Overall, the reduced asset beta case estimates in panel B suggest that lower grade bonds in these highly leveraged transactions bear somewhat more systematic risk than that found in previous studies of lower grade bonds. The results of this case are less conclusive about the riskiness of commercial bank loans in highly leveraged transactions.

5.   Direct Beta Estimates for Lower Grade Bonds

To compare our implicit methodology with more conventional techniques, we also directly estimate the beta or systematic risk of the lower grade bonds of the recapitalizations in our sample. Morgan Stanley provided weekly desk prices for 8 bonds for 8 different companies in our sample for the six months after the completion of the recapitalization. These prices are not necessarily transaction prices, but, instead, are the prices Morgan Stanley's high yield group believed to be in effect at the close of business on Tuesday of each week. The prices do not include accrued interest. As in work by others on lower grade bonds, we assume that interest on the bonds accrues at fixed rate with certainty over our estimation period. This allows us to ignore interest payments in our beta calculations.

For each of the 8 bonds, we estimated betas using weekly returns on the bonds and on the value-weighted index for the six month period after the recapitalization completions. Table 8 presents the results of these estimates. The average and median betas for these 8 bonds are 0.21 and 0.28,

respectively, with a standard error of 0.05. The maximum beta estimate is only 0.32 for Owens Corning Fiberglas. These estimates are lower than the betas estimated for all debt under both the base and second case assumptions.

Because it is possible that the delayed adjustment of bond prices creates a downward bias on the beta estimates, we also estimate betas using the estimator suggested by Scholes-Williams (1977). The Scholes-Williams estimates have a large effect on the beta estimates, increasing the average debt beta to 0.41.[24] The direct Scholes-Williams beta estimates in Table 8 are not significantly different from the implicit betas on all debt in the reduced asset beta case. The highest direct estimates, therefore, correspond to the very bottom of the range of betas for lower grade bonds implied by our methodology -- those assuming both a reduced asset beta and bank debt that is as risky as the lower grade debt.

As soon as either of these assumptions is relaxed, our implicit betas for lower grade debt exceed the direct estimates. For example, if we maintain the reduced asset beta assumption, but assume that lower grade debt has twice the systematic risk of bank debt, we estimate an average implicit beta on the lower grade debt beta of 0.54 for the eight companies with direct beta estimates. This is significantly greater than 0.41 at the 5% level (one-tailed test).

One possible explanation for the difference between the indirect and direct estimates is data quality problems with the direct estimates. The fact that the direct estimates increase substantially with the Scholes-Williams estimator lends some credence to the notion that data quality problems can lead to downward biases, at least at weekly return horizons. The higher direct estimates based on longer horizons may be, themselves, downward biased, if the quoted prices do not accurately reflect true market values.

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[24] Market-model estimates using monthly returns and estimates using the Dimson (1979) technique produce similar results.

6. Conclusion

In this paper, we have presented indirect estimates of the systematic risk of debt in public leveraged recapitalizations which we calculate as a function of the difference between pre- and post-recapitalization equity risk. Equity risk (using the value-weighted index) rises surprisingly little after a recapitalization -- by 28% to 52%, depending on the estimation method. The small increase in equity betas can be attributed to high debt riskiness and/or reductions in asset betas. Under the assumption that asset beta is unchanged, we find the implied systematic risk of the post-recapitalization debt in twelve transactions averages 0.67 (with a standard error of 0.06). Under the alternative assumption that the entire market-adjusted premium in the leveraged recapitalization represents a reduction in fixed costs, we find the implied systematic risk of total debt averages 0.42 (with a standard error of 0.05). Under the assumption that lower grade debt has twice the systematic risk of bank debt, these estimates translate into lower grade debt betas of 0.93 and 0.57, respectively -- significantly higher than reported in previous research on low grade debt. (Again, we note that the debt in highly leveraged transactions may have different risk characteristics than other low grade debt.)

Our results are best thought of as yielding a reasonable range of values for debt riskiness, rather than a single "best" estimate. It is certainly plausible that changes occur in the management of recapitalized companies that lead to reductions in fixed costs, although it is difficult to verify this empirically. Existing research on highly leveraged management buyouts points to increases in cash flow and reductions in taxes paid as sources of value. Both of these may have substantial fixed components. (See Kaplan (1989a and 1989b).)

Debt betas at the upper end of our range raise questions about the role of debt pricing in explaining the premiums in highly leveraged transactions. Given the magnitude of the debt used in highly levered transactions, even modest variations in its pricing, ex ante, can have a large effect on stockholder wealth. If a firm's capital structure is 90% debt, the debt is permanent, and the interest rate on the debt is mispriced by 2 percentage points - say a 13% interest rate instead of 15% - a buyer can pay 13.8% more than the true value of the firm (.9*(.15-.13)/.13). This is approximately 30% of the

premium seen in a typical buyout transaction. To the extent that the debt in highly leveraged transactions is not permanent, this effect will be smaller.

If the constant asset beta scenario is appropriate, the resulting debt beta of 0.67 (combined with conventional estimates of the market premium of 5% to 8%) implies that debt should have an expected return at least 3.3% above the risk-free rate. The bank debt in our sample promises a yield of approximately 3.25% above that of Treasury Bills, on average; the low grade debt, a yield to maturity 3.0% above that of comparable Treasury Bonds. Expected returns, however, will be lower than promised yields. If the default experience reported by Asquith et al (1989), Altman (1989), and Blume and Keim (1989) is any guide, the expected premiums of bank debt and lower grade bonds over the risk free rate may be lower, possibly as low as the 1% found by Blume and Keim (1989). Our constant asset beta case estimates are, thus, potentially consistent with the debtholders in our sample not receiving adequate compensation for the risk they bear.[25]

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[25] This interpretation would not necessarily imply that mispricing of new debt is the only source of value. Also, it should be stressed that if mispricing exists, it need not reflect investor irrationality per se. Rather, incentive problems could be responsible. A large portion of debt in the transactions is provided by commercial banks with access to federally insured deposits. Bryan (1988) has argued that overcapacity in the banking industry, combined with the lack of capital market discipline inherent in deposit insurance, has led commercial banks to systematically undertake negative net present value investments - an argument analogous to the free cash flow theory used by Jensen (1986) to explain overinvestment by industrial corporations. If Bryan's hypothesis is correct, aggressive bank lending to highly leveraged transactions could be one manifestation of a broader phenomenon.

25

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TABLE 1
PRE- AND POST-RECAPITALIZATION CAPITAL STRUCTURES

Descriptive statistics for pre- and post-recapitalization capital structure for 12 leveraged recapitalizations completed from 1985 to 1988.[a]

| Company | Recap Completed | Pre-Recapitalization[b] | | | | Post-Recapitalization[c] | | | |
| | | Debt | Prf'd | Common | Total | Debt | Prf'd | Common | Total |
		(as % of total capital)			Capital ($ MM)	(as % of total capital)			Capital ($ MM)
1. Coit Industries	10/08/86	11.3	0.0	88.7	1,527	84.0	0.0	16.0	2,103
2. FMC	05/29/86	14.6	0.0	85.4	1,916	74.4	0.0	25.6	2,554
3. Fruehauf	12/24/86	41.6	0.0	58.4	1,245	83.6	13.9	2.4	1,916
4. Harcourt Brace Jovanovich	07/28/87	27.7	0.0	72.3	2,488	70.2	13.0	16.7	3,656
5. Holiday	04/22/87	49.5	0.0	50.5	2,640	88.2	0.0	11.8	3,364
6. Interco	12/23/88	26.6	0.0	73.4	2,083	84.7	11.2	4.1	2,955
7. Kroger	12/05/88	28.7	6.1	65.2	4,099	87.8	0.0	12.2	6,286
8. Multimedia	10/02/85	8.6	0.0	91.4	611	81.1	0.0	18.9	1,115
9. Owens Corning Fiberglas	11/06/86	27.2	0.0	72.8	2,085	84.3	0.0	15.7	2,929
10. Shoney's	08/04/88	1.7	0.0	98.3	762	72.9	0.0	27.1	1,041
11. Swank	03/01/88	31.9	0.0	68.1	83	74.8	0.0	25.2	94
12. USG	07/14/88	37.0	0.0	63.0	2,301	89.4	0.0	10.6	3,495
Average		25.5	0.5	74.0	1,824	81.3	3.2	15.5	2,626
Median		27.5	0.0	72.5	2,025	83.8	0.0	15.9	2,742

Financial data were obtained from proxy and 10-K statements describing the recapitalizations.

Pre-recapitalization market value of equity equals the common stock price 40 trading days before the recapitalization announcement times the number of primary shares outstanding plus the book value of convertible debt. Debt equals the book value of non-convertible debt less the excess cash used to finance the transaction. Preferred stock equals the book value of preferred stock. Debt and preferred stock are obtained from the proxy or 10-K statements describing the transaction. Total capital is the sum of (1) the market value of equity (40 trading days before the announcement); (2) debt; and (3) preferred stock.

Post-recapitalization market value of equity equals the closing common stock price the day the recapitalization is completed times the number of primary shares outstanding after the recapitalization. Debt and preferred stock are equal to the book value of debt and preferred stock after the recapitalization as given in the proxy or 10-K statements describing the transaction. Total capital is the sum of (1) the market value of equity (the day the recapitalization is completed); (2) debt; and (3) preferred stock.

TABLE 2
SUMMARY STATISTICS FOR RECAPITALIZATIONS

Descriptive statistics for premium, leverage, bank debt and lower grade debt for 12 leveraged recapitalizations completed from 1985 to 1988.[a]

Variable	Mean	Median	Std. Dev.	N
Premium - Return on common stock from two months before recapitalization announcement to recapitalization completion[b]	57.0%	62.2%	21.2%	12
Market-Adjusted Premium on common stock from two months before recapitalization announcement to recapitalization completion[b]	44.9%	47.0%	19.9%	12
Pre-recapitalization total debt as percentage of value of total capital at time of recapitalization[c]	18.3%	18.8%	10.7%	12
Post-recapitalization total debt as percentage of value of total capital at time of recapitalization[c]	81.3%	83.8%	6.5%	12
Post-recapitalization bank debt as a percentage of total post-recapitalization debt[d]	58.6%	56.6%	14.7%	12
Post-recapitalization public lower grade debt as a percentage of total post-recapitalization debt[d]	25.2%	29.3%	11.1%	12
Interest rate on bank debt[e]				
Spread over Prime Rate	1.48%	1.50%	0.129%	12
Spread over LIBOR	2.46%	2.50%	0.144%	12
Yield to maturity on public lower grade debt less yield on comparable Treasury Bond[f]	5.01%	4.96%	0.969%	11
Asset sales from recapitalization announcement to six months after recapitalization completion as a percentage of total capital at time of recapitalization[c,g]	9.5%	7.5%	10.5%	12

[a] Financial data were obtained from proxy and 10-K statements describing the recapitalizations.
[b] Premium is calculated as the percentage difference between the common stock price the day before the recapitalization is completed and the common stock price 40 trading days before the recapitalization is announced. The announcement day of the hostile bid is used, if the recapitalization is a response to a previous hostile bid. Market-adjusted premium equals the premium divided by 1 plus the return on the value-weighted market index during the same time period.
[c] Pre-recapitalization debt equals pre-recapitalization book value of debt less excess cash used to finance the transactions. Value of total capital at the recapitalization equals the sum of (1) the final recapitalization equity value; (2) the pre-recapitalization debt; (2) the market value of common stock (using the fully diluted number of shares) the day before the recapitalization is completed; and (3) the pre-recapitalization book value of preferred stock. Convertible debt is treated as equity.
[d] Bank debt is debt provided by commercial banks to finance the recapitalization. Public lower grade debt is newly issued debt used to finance the recapitalization which is rated Ba or below by Moody's Investor Services. One recapitalization, Swank, did not use lower grade debt.
[e] Required interest rates on bank debt are quoted as spreads above the Prime Rate or LIBOR (London Interbank Offer Rate). Each period, the borrower has the option to pay the lower rate (including spread).
[f] Yields to maturity for Treasury Bonds with similar maturities are obtained from Salomon Brothers Analytical Bond Record for the month the lower grade bonds are issued. For issuers with more than one lower grade bond outstanding, the average of the spreads is used.
[g] Asset sales equal the proceeds from announced asset sales by the recapitalization companies.

TABLE 3
PRE- AND POST-RECAPITALIZATION EQUITY BETAS

Pre- and post-recapitalization equity betas and standard errors using market model and Scholes-Williams estimates using daily data and market model estimates using weekly data for 12 leveraged recapitalizations completed from 1985 to 1988. All estimates use the value-weighted index.

Company	Panel A: Market Model Daily Data[a]		Panel B: Scholes-Williams Daily Data[b]		Panel C: Market Model Weekly Data[c]	
	Pre-Equity Beta (S.E.)	Post-Equity Beta (S.E.)	Pre-Equity Beta (S.E.)	Post-Equity Beta (S.E.)	Pre-Equity Beta (S.E.)	Post-Equity Beta (S.E.)
1. Colt Industries	0.63 (0.16)	1.29 (0.26)	0.72 (0.16)	1.30 (0.26)	0.64 (0.29)	1.75 (0.65)
2. FMC	0.88 (0.17)	1.09 (0.16)	0.66 (0.17)	1.11 (0.16)	0.52 (0.33)	1.07 (0.36)
3. Fruehauf	0.76 (0.24)	0.73 (0.50)	0.46 (0.24)	1.39 (0.50)	0.53 (0.59)	1.30 (1.03)
4. Harcourt Brace Jovanovich	1.85 (0.24)	1.68 (0.24)	1.80 (0.24)	1.49 (0.24)	2.27 (0.39)	1.22 (0.69)
5. Holiday	0.75 (0.14)	1.65 (0.32)	0.78 (0.14)	1.64 (0.32)	0.72 (0.26)	0.83 (0.64)
6. Interco	0.93 (0.12)	1.48 (0.50)	0.81 (0.12)	1.40 (0.50)	0.82 (0.24)	0.31 (0.93)
7. Kroger	1.20 (0.19)	0.93 (0.24)	1.20 (0.19)	1.08 (0.24)	0.67 (0.50)	1.17 (0.56)
8. Multimedia	0.75 (0.19)	1.22 (0.27)	1.00 (0.19)	2.18 (0.27)	1.27 (0.42)	2.25 (0.97)
9. Owens Corning Fiberglas	1.10 (0.17)	1.86 (0.31)	1.34 (0.17)	2.13 (0.31)	1.34 (0.36)	1.36 (0.74)
10. Shoney's	0.76 (0.13)	1.20 (0.34)	0.60 (0.13)	1.54 (0.34)	0.90 (0.26)	1.82 (0.56)
11. Swank	1.19 (0.30)	0.84 (0.47)	1.11 (0.30)	1.20 (0.47)	1.49 (0.62)	2.14 (1.04)
12. USG	1.37 (0.22)	1.45 (0.36)	1.47 (0.22)	1.67 (0.36)	1.31 (0.60)	2.12 (0.52)
Average	1.01	1.29	1.00	1.52	1.04	1.44
Median	0.91	1.25	0.91	1.44	0.86	1.33
S.E.[d]	0.06	0.10	0.06	0.10	0.12	0.22

[a] Pre-recapitalization equity betas, β^E_o, are calculated using daily returns, the market model and the value-weighted index from 165 trading days to 40 trading days prior to the recapitalization announcement. Post-recapitalization equity betas, β^E_n, are calculated using daily returns, the market model and the value-weighted index from 3 trading days to 128 trading days after the recapitalization is completed. All estimates are based on at least 100 observations.

Table 3 (continued)

[b] Pre-recapitalization equity betas, β^E_o, are calculated using daily returns, Scholes-Williams beta estimates and the value-weighted index from 165 trading days to 40 trading days prior to the recapitalization announcement. Post-recapitalization equity betas, β^E_n, are calculated using daily returns, Scholes-Williams estimates and the value-weighted index from 3 trading days to 128 trading days after the recapitalization is completed. All estimates are based on at least 100 observations.

[c] Pre-recapitalization equity betas, β^E_o, are calculated using weekly returns, the market model and the value-weighted index from 165 trading days to 40 trading days prior to the recapitalization announcement. Post-recapitalization equity betas, β^E_n, are calculated using weekly returns, the market model and the value-weighted index from 3 trading days to 128 trading days after the recapitalization is completed. All estimates are based on at least 20 observations.

[d] The standard errors (S.E.s) of the individual firm equity betas, both pre- and post-recapitalization, are calculated from in the regressions used to estimate the betas. The standard errors of the average pre- and post-recapitalization equity betas are calculated as:

$$\left(\sum_{i=1}^{k} \mathrm{Var}\,(\beta_i) \ / \ k^2 \right)^{.5}$$

where β_i is the relevant β for firm i and k is the number of sample firms.

TABLE 4A
IMPLIED DEBT BETAS - CONSTANT ASSET BETA CASE

Pre-recapitalization equity betas and asset betas, post-recapitalization equity betas and implicit debt betas assuming pre- and post-recapitalization asset betas are equal, and that pre-recapitalization debt beta is 0.15 for 12 leveraged recapitalizations completed from 1985 to 1988.

Company	Pre-Recapitalization		Post-Recapitalization			
	Equity Beta[a]	Asset Beta[b]	Equity Beta[a]	Asset Beta From Equity[c]	Implicit Beta All Debt[d]	Std. Error Implicit Beta[e]
1. Colt Industries	0.63	0.57	1.29	0.21	0.44	0.18
2. FMC	0.88	0.77	1.09	0.28	0.66	0.20
3. Fruehauf	0.76	0.51	0.73	0.12	0.46	0.20
4. Harcourt Brace Jovanovich	1.85	1.38	1.68	0.50	1.25	0.26
5. Holiday	0.75	0.46	1.65	0.20	0.29	0.09
6. Interco	0.93	0.72	1.48	0.23	0.59	0.16
7. Kroger	1.20	0.90	0.93	0.11	0.89	0.14
8. Multimedia	0.75	0.70	1.22	0.23	0.58	0.23
9. Owens Corning Fiberglas	1.10	0.84	1.86	0.29	0.65	0.16
10. Shoney's	0.76	0.75	1.20	0.33	0.58	0.22
11. Swank	1.19	0.83	0.84	0.21	0.82	0.31
12. USG	1.37	0.92	1.45	0.15	0.85	0.16
Average	1.01	0.78	1.29	0.24	0.67	0.06
Median	0.91	0.76	1.25	0.22	0.62	

[a] Pre-recapitalization equity betas, β^E_o, are calculated using the market model and the value-weighted index from 165 trading days to 40 trading days prior to the recapitalization announcement. Post-recapitalization equity betas, β^E_n, are calculated using the market model from 3 trading days to 128 trading days after the recapitalization is completed.

[b] Pre-recapitalization asset betas, β^A_o, equal:

$$\beta^A_o \quad = \quad \beta^E_o \frac{E_o}{E_o + D_o} + \beta^D_o \frac{D_o}{E_o + D_o}$$

where β^E_o is the pre-recapitalization equity beta, E_o is the market value of equity using primary shares 40 trading days before the recapitalization announcement plus the book value of preferred stock and convertible debt, D_o is the book value of non-convertible debt less excess cash used to finance the transaction obtained from the financial statement describing the recapitalization, and β^D_o is the pre-recapitalization debt beta which is assumed to equal 0.15.

[c] Post-recapitalization asset betas from equity equal $\beta^E_n * E_n / (E_n + D_n)$. β^E_n is the pre-recapitalization equity beta, E_n is the market value of equity using primary shares after the recapitalization is completed plus the book value of preferred stock and D_n is the book value of debt after the recapitalization is completed.

[d] Implicit beta on all post-recapitalization debt, β^D_n assumes the post-recapitalization asset beta, β^A_n, equals the pre-recapitalization asset beta. β^D_n is calculated as:

$$\beta^D_n \quad = \quad - \frac{[E_n + D_n]}{D_n} [\beta^A_o - \beta^E_n * \frac{E_n}{E_n + D_n}]$$

[e] The variance of the implicit debt beta for firm i, Var $(\beta^D_{n,i})$, is calculated as:

$$Var (\beta^D_{n,i}) = S^2_{old} + S^2_{new}.$$

where: $\quad S^2_{old} \quad = [E_o/(E_o + D_o)]^2 * [(E_n + D_n)/D_n)]^2 * S^2_{Eo};$ and

$\quad\quad\quad S^2_{new} \quad = [E_n/D_n]^2 * S^2_{En}$

S^2_{Eo} and S^2_{En} are the estimated variances of the pre- and post-recapitalization equity betas.
The average standard error of 0.06 is the standard error of the average implied debt beta. This is calculated as:

$$(\sum_{i=1}^{k} Var (\beta^D_{n,i}) / k^2)^{.5}$$

where k is the number of sample firms.

Pre-recapitalization equity betas and asset betas, post-recapitalization equity betas and implicit debt betas assuming total market-adjusted premium represents reduction in fixed costs, and that pre-recapitalization debt beta is 0.15 for 12 leveraged recapitalizations completed 1985 to 1988.

Company	Pre-Recapitalization		Post-Recapitalization			
	Equity Beta[a]	Asset Beta Adjusted[b]	Equity Beta[a]	Asset Beta From Equity[c]	Implicit Beta All Debt[d]	Std. Error Implicit Beta[e]
1. Colt Industries	0.63	0.42	1.29	0.21	0.26	0.13
2. FMC	0.88	0.70	1.09	0.28	0.57	0.19
3. Fruehauf	0.76	0.36	0.73	0.12	0.29	0.16
4. Harcourt Brace Jovanovich	1.85	0.96	1.68	0.50	0.66	0.20
5. Holiday	0.75	0.40	1.65	0.20	0.23	0.08
6. Interco	0.93	0.55	1.48	0.23	0.39	0.12
7. Kroger	1.20	0.59	0.93	0.11	0.55	0.11
8. Multimedia	0.75	0.40	1.22	0.23	0.21	0.14
9. Owens Corning Fiberglas	1.10	0.61	1.86	0.29	0.38	0.12
10. Shoney's	0.76	0.63	1.20	0.33	0.42	0.19
11. Swank	1.19	0.65	0.84	0.21	0.59	0.26
12. USG	1.37	0.65	1.45	0.15	0.55	0.12
Average	1.01	0.58	1.29	0.24	0.42	0.05
Median	0.91	0.60	1.25	0.22	0.40	

[a] Pre-recapitalization equity betas, β^E_o, are calculated using the market model and the value-weighted index from 165 trading days to 40 trading days prior to the recapitalization announcement. Post-recapitalization equity betas, β^E_n, are calculated using the market model and the value-weighted index from 3 trading days to 128 trading days after the recapitalization is completed. The standard errors of the equity beta estimates are the same as those in Table 3A.

[b] Pre-recapitalization asset betas adjusted for reduction in fixed costs, $\beta^{A\bullet}_o$, equal:

$$\beta^{A\bullet}_o \quad = \quad [\ \beta^E_o \frac{E_o}{E_o + D_o} + \beta^D_o \frac{D_o}{E_o + D_o}\ ] \cdot [\frac{E_o + D_o + Mkt_o}{E_n + D_n}\ ]$$

where β^E_o is the pre-recapitalization equity beta, E_o is the market value of equity using primary shares 40 trading days before the recapitalization announcement plus the book value of preferred stock and convertible debt, D_o is the book value of non-convertible debt less excess cash used to finance the transaction obtained from the financial statement describing the recapitalization, β^D_o is the pre-recapitalization debt beta which is assumed to equal 0.15, Mkt_o is the product of E_o and the value-weighted market return from 40 trading days before the recapitalization announcement to recapitalization completion, E_n is the market value of equity using primary shares after the recapitalization is completed plus the book value of preferred stock, and D_n is the book value of debt after the recapitalization is completed.

[c] Post-recapitalization asset betas from equity are calculated as:

$$= \quad \beta^E_n \cdot E_n / (E_n + D_n)$$

where β^E_n is the post-recapitalization equity beta.

[d] Implicit beta on all post-recapitalization debt, β^D_n, assumes the post-recapitalization asset beta, β^A_n, equals the pre-recapitalization asset beta. β^D_n is calculated as:

$$\beta^D_n \quad = \quad \frac{[E_n + D_n]}{D_n} [\ \beta^{A\bullet}_o - \beta^E_n \cdot \frac{E_n}{E_n + D_n}]$$

Table 4B (continued)

^{e} The variance of the implicit debt beta for firm i, Var ($\beta^D_{n,i}$), is calculated as:

$$\text{Var } (\beta^D_{n,i}) = S^2_{old} + S^2_{new}$$

where:

$$S^2_{old} = [E_o / (E_o + D_o)]^2 * [(E_o + D_o + \text{Mkt}_o) / D_n)]^2 * S^2_{E_o} ; \text{ and}$$

$$S^2_{new} = [E_n/D_n]^2 * S^2_{E_n}$$

$S^2_{E_o}$ and $S^2_{E_n}$ are the estimated variances of the pre- and post-recapitalization equity betas.

The average standard error of 0.05 is the standard error of the average implied debt beta. This is calculated as:

$$(\sum_{i=1}^{k} \text{Var } (\beta^D_{n,i}) / k^2)^{.5}$$

where k is the number of sample firms.

TABLE 5
CHANGE IN ASSET BETAS IMPLIED BY FIXING DEBT BETAS

Pre-recapitalization equity betas and asset betas, post-recapitalization equity betas and asset betas, and change in and percentage change in asset betas, assuming that pre-recapitalization debt beta is 0.15 and post-recapitalization beta is 0.25 for 12 leveraged recapitalizations completed 1985 to 1988.

	Pre-Recapitalization		Post-Recapitalization				
	Equity Beta[a]	Asset Beta[b]	Equity Beta[a]	Asset Beta[c]	Change in Asset Beta	Std. Error Change in Asset Beta[d]	Percentage Change in Asset Beta
Average	1.01	0.78	1.29	0.42	-0.34	0.05	-46%
Median	0.91	0.76	1.25	0.44	-0.30		-42%

[a] Pre-recapitalization equity betas, β^E_o, are calculated using the market model and the value-weighted index from 165 trading days to 40 trading days prior to the recapitalization announcement. Post-recapitalization equity betas, β^E_n, are calculated using the market model and the value-weighted index from 3 trading days to 128 trading days after the recapitalization is completed.

[b] Pre-recapitalization asset betas, β^A_o, equal:

$$\beta^A_o \quad = \quad \beta^E_o \frac{E_o}{E_o + D_o} + \beta^D_o \frac{D_o}{E_o + D_o}$$

where β^E_o is the pre-recapitalization equity beta, E_o is the market value of equity using primary shares 40 trading days before the recapitalization announcement plus the book value of preferred stock and convertible debt, D_o is the book value of non-convertible debt less excess cash used to finance the transaction obtained from the financial statement describing the recapitalization, and β^D_o is the pre-recapitalization debt beta which is assumed to equal 0.25.

[c] Post-recapitalization asset betas are calculated as:

$$\beta^A_n \quad = \quad \beta^E_n \frac{E_n}{E_n + D_n} + \beta^D_n \frac{D_n}{E_n + D_n}$$

where β^E_n is the post-recapitalization equity beta, E_n is the market value of equity using primary shares after the recapitalization is completed plus the book value of preferred stock, D_n is the book value of debt after the recapitalization is completed, and β^D_n is the post-recapitalization debt beta which is assumed to equal 0.25.

[d] The variance of the change in asset beta for firm i, $Var(\beta^A_{o,i} - \beta^A_{n,i})$, is calculated as:

$$Var(\beta^A_{o,i} - \beta^A_{n,i}) = S^2_{old} + S^2_{new}.$$

where: $S^2_{old} \quad = \quad [E_o/(E_o + D_o)]^2 \cdot S^2_{E_o}$; and

$S^2_{new} \quad = \quad [E_n/(E_n + D_n)]^2 \cdot S^2_{E_n}$

$S^2_{E_o}$ and $S^2_{E_n}$ are the estimated variances of the pre- and post-recapitalization equity betas.
The average standard error of 0.05 is the standard error of the average implied debt beta. This is calculated as:

$$(\sum_{i=1}^{k} Var(\beta^A_{o,i} - \beta^A_{n,i}) / k^2)^{.5}$$

where k is the number of sample firms.

TABLE 6

SENSITIVITY ANALYSIS FOR IMPLIED DEBT BETAS

Means and medians [in brackets] of pre-recapitalization equity betas and asset betas, post-recapitalization equity betas and implicit debt betas under different assumptions for 12 leveraged recapitalizations completed 1985 to 1988.

	Pre-Recapitalization		Post-Recapitalization			
	Equity Beta	Asset Beta	Equity Beta	Asset Beta From Equity	Implicit Beta All Debt	Std. Error Implicit Beta[i]
1. Constant asset beta case with beta of 0.0 on old debt.[a,b]	1.01 [0.91]	0.74 [0.75]	1.29 [1.25]	0.24 [0.22]	0.63 [0.59]	0.06
2. Reduced asset beta case with beta of 0.0 on old debt.[c,d]	1.01 [0.91]	0.55 [0.57]	1.29 [1.25]	0.24 [0.22]	0.39 [0.38]	0.05
3. Constant asset beta case with preferred stock treated as debt[e]	1.01 [0.91]	0.77 [0.76]	1.29 [1.25]	0.20 [0.21]	0.72 [0.66]	0.06
4. Constant asset beta case with market model betas using equal-weighted index.[f]	1.47 [1.13]	1.11 [1.05]	2.47 [2.44]	0.47 [0.44]	0.81 [0.70]	0.09
5. Constant asset beta case with market model betas using S&P 500 index.[g]	0.85 [0.78]	0.67 [0.66]	1.09 [1.11]	0.20 [0.20]	0.58 [0.56]	0.05
6. Constant asset beta case with Scholes-Williams Betas.[h]	1.00 [0.91]	0.77 [0.73]	1.51 [1.44]	0.28 [0.26]	0.61 [0.59]	0.06
7. Constant asset beta case using market model and weekly returns.[i]	1.04 [0.86]	0.81 [0.76]	1.44 [1.33]	0.28 [0.25]	0.67 [0.62]	0.12
8. Constant asset beta case using market value of common stock eight months before announcement and six months after completion.[j]	1.01 [0.91]	0.77 [0.77]	1.29 [1.25]	0.28 [0.25]	0.62 [0.56]	0.06
9. Constant asset beta case with debt one-year after the transaction.[k]	1.01 [0.91]	0.78 [0.76]	1.29 [1.25]	0.24 [0.23]	0.67 [0.63]	0.06

[a] Under constant asset beta case assumptions:

1. Pre-recapitalization equity betas, β^E_o, are calculated using the market model and the value-weighted index from 165 trading days to 40 trading days prior to the recapitalization announcement. Post-recapitalization equity betas, β^E_n, are calculated using the market model and the value-weighted index from 3 trading days to 128 trading days after the recapitalization is completed.

2. Pre-recapitalization asset betas, β^A_o, equal:

$$\beta^A_o = \beta^E_o \frac{E_o}{E_o + D_o} + \beta^D_o \frac{D_o}{E_o + D_o}$$

where β^E_o is the pre-recapitalization equity beta, E_o is the market value of equity using primary shares 40 trading days before the recapitalization announcement plus the book value of preferred stock and convertible debt, D_o is the book value of non-convertible debt less excess cash used to finance the transaction obtained from the financial statement describing the recapitalization, and β^D_o is the pre-recapitalization debt beta which is assumed to equal 0.15.

TABLE 6 (continued)

3. Post-recapitalization asset betas from equity = $\beta^E_n \cdot E_n / (E_n + D_n)$. Where E_n is the market value of equity using primary shares after the recapitalization is completed plus the book value of preferred stock and D_n is the book value of debt after the recapitalization is completed.

4. Implicit beta on all post-recapitalization debt, β^D_n, assumes the post-recapitalization asset beta, β^A_n, equals the pre-recapitalization asset beta, β^A_o. β^D_n is calculated as:

$$\beta^D_n \quad = \quad \frac{[E_n + D_n]}{D_n} [\ \beta^A_o - \beta^E_n \cdot \frac{E_n}{E_n + D_n}]$$

[b] Same as constant asset beta case except pre-recapitalization debt assumed to have a beta of 0.0, not 0.15.

[c] Reduced asset beta case is same as constant asset beta case except pre-recapitalization asset betas adjusted for reductions in fixed costs, β^{A*}_o, equal:

$$\beta^A_n \quad = \quad \beta^A_o \cdot \frac{E_o + D_o + Mkt_o}{E_n + D_n}$$

where Mkt_o equals the product of E_o and the value-weighted market return from 40 trading days before the recapitalization announcement to recapitalization completion.

[d] Same as reduced asset beta case except pre-recapitalization debt assumed to have a beta of 0.0, not 0.15.

[e] Same as constant asset beta case except preferred stock is treated as debt.

[f] Same as constant asset beta case except equity betas are estimated using the equal weighted index. Calculated for only 10 companies, because equal-weighted index returns are not available for Interco and Kroger.

[g] Same as constant asset beta case except equity betas are estimated using the S&P 500 index (without dividends).

[h] Same as constant asset beta case except Scholes-Williams technique used to estimate equity betas.

[i] Same as constant asset beta case except equity betas calculated using weekly returns.

[j] Same as constant asset beta case except using market value of common stock calculated eight months before announcement (i.e., the start of the estimation period) for pre-recapitalization capital structure and market value of common stock six months after completion for post-recapitalization capital structure (i.e., the end of the estimation period).

[k] Same as constant asset beta case except post-recapitalization book value of debt taken (when available) from financial statement after beta estimation period. Post-estimation book value of debt not available for two companies.

[l] The variance of the implicit debt beta for firm i, Var $(\beta^D_{n,i})$, is calculated as:

$$Var\ (\beta^D_{n,i}) \quad = S^2_{old} + S^2_{new}.$$

where:

$$S^2_{old} \quad = [E_o/(E_o + D_o)]^2 \cdot [(E_n + D_n)/D_n)]^2 \cdot S^2_{Eo} \text{ in the constant asset beta case;}$$

$$S^2_{old} \quad = [E_o/(E_o + D_o)]^2 \cdot [(E_o + D_o + Mkt_o)/D_n)]^2 \cdot S^2_{Eo} \text{ in the reduced asset beta case; and}$$

$$S^2_{new} \quad = [E_n/D_n]^2 \cdot S^2_{En}.$$

S^2_{Eo} and S^2_{En} are the estimated variances of the pre- and post-recapitalization equity betas.
The average standard error is the standard error of the average implied debt beta. This is calculated as:

$$(\sum_{i=1}^{k} Var\ (\beta^D_{n,i}) / k^2\ )^{.5}$$

where k is the number of sample firms.

TABLE 7
IMPLIED BETAS OF BANK DEBT AND LOW GRADE DEBT

Implicit betas on bank and lower grade debt if (1) lower grade debt has the same systematic risk as bank debt,[a] (2) lower grade debt has twice the systematic risk of bank debt,[b] and (3) bank debt has no systematic risk[c] assuming pre-recapitalization debt beta is 0.15, for constant and reduced asset beta cases for 12 leveraged recapitalizations completed 1985 to 1988.

	Implicit Betas Same Systematic Risk[a]		Implicit Betas Lower Grade Debt Twice the Systematic Risk[b]		Implicit Betas Lower Grade Debt Has All Systematic Risk[c]	
	Bank Debt	Lower Grade Debt	Bank Debt	Lower Grade Debt	Bank Debt	Lower Grade Debt
A. Constant Asset Beta Case						
Average	0.67	0.66	0.46	0.93	0.00	1.64
Median	0.62	0.59	0.45	0.90	0.00	1.40
Std. Error[d]	0.06	0.06	0.04	0.08	0.00	0.16
B. Reduced Asset Beta Case						
Average	0.42	0.40	0.29	0.57	0.00	1.00
Median	0.40	0.39	0.27	0.54	0.00	0.90
Std. Error[d]	0.05	0.05	0.03	0.06	0.00	0.12

[a] Implicit beta on all post-recapitalization debt, β^D_n, in the constant asset beta case assumes the post-recapitalization asset beta, β^A_n, equals the pre-recapitalization asset beta, β^A_o. β^D_n is calculated as:

$$\beta^D_n = \frac{[E_n + D_n]}{D_n} [\beta^A_o - \beta^E_n \cdot \frac{E_n}{E_n + D_n}]$$

where pre-recapitalization asset betas, β^A_o, equal:

$$\beta^A_o = \beta^E_o \frac{E_o}{E_o + D_o} + \beta^D_o \frac{D_o}{E_o + D_o}$$

The implicit beta on all post-recapitalization debt in the reduced asset beta case is calculated as:

$$\beta^D_n = \frac{[E_n + D_n]}{D_n} [\beta^{A*}_o - \beta^E_n \cdot \frac{E_n}{E_n + D_n}]$$

where post-recapitalization asset betas, β^A_n, equal pre-recapitalization asset betas adjusted for reduction in fixed costs, β^{A*}_o:

$$\beta^{A*}_o = [\beta^E_o \frac{E_o}{E_o + D_o} + \beta^D_o \frac{D_o}{E_o + D_o}] \cdot [\frac{E_o + D_o + Mkt_o}{E_n + D_n}]$$

E_o is the market value of equity using primary shares 40 trading days before the recapitalization announcement plus the book value of preferred stock and convertible debt, D_o is the book value of non-convertible debt less excess cash obtained from the financial statement describing the recapitalization, Mkt_o is the product of E_o and the value-weighted market return from 40 trading days before the recapitalization announcement to recapitalization completion, E_n is the market value of equity using primary shares after the recapitalization is completed plus the book value of preferred stock, and D_n is the book value of debt after the recapitalization is completed. Pre-recapitalization equity betas, β^E_o, are calculated using market model and value-weighted index from 165 trading days to 40 trading days before the recapitalization announcement. Pre-recapitalization debt betas, β^D_o, are assumed to equal 0.15. Post-recapitalization equity betas, β^E_n, are calculated using market model from 3 trading days to 128 trading days after the recapitalization is completed.

Table 7 (continued)

[b] Beta on lower grade debt, β^{LG}_n, when lower grade debt has twice the systematic risk of bank debt is calculated as:

$$\beta^{LG}_n \quad = \quad \beta^{D}_n \cdot \frac{D_n}{D^{LG}_n + 0.5 \cdot D^{B}_n}$$

where D^{LG}_n is the amount of lower grade debt and D^{B}_n is the amount of bank debt after the recapitalization. Classifies all non-bank debt as lower grade debt, i.e., $D^{LG}_n = D_n - D^{B}_n$.

[c] Beta on lower grade debt, β^{LG}_n, when lower grade debt has all systematic risk is:

$$\beta^{LG}_n \quad = \quad \beta^{D}_n \cdot \frac{D_n}{D^{LG}_n}$$

[d] The variance of the implicit debt beta for firm i, $\text{Var}(\beta^{D}_{n,i})$, is calculated as:

$$\text{Var}(\beta^{D}_{n,i}) = S^2_{old} + S^2_{new}.$$

where:

$S^2_{old} \quad = [E_o/(E_o + D_o)]^2 \cdot [(E_n + D_n)/D_n)]^2 \cdot S^2_{Eo}$ in the constant asset beta case;

$S^2_{old} \quad = [E_o/(E_o + D_o)]^2 \cdot [(E_o + D_o + Mkt_o)/D_n)]^2 \cdot S^2_{Eo};$ in the reduced asset beta case;

$S^2_{new} \quad = [E_n/D_n]^2 \cdot S^2_{En}$

S^2_{Eo} and S^2_{En} are the estimated variances of the pre- and post-recapitalization equity betas.

The variances of the bank and lower grade debt betas for each firm are calculated as functions of the variance of the implicit debt betas.

Standard errors of the average implied debt betas are calculated as:

$$\left(\sum_{i=1}^{k} \text{Var}(\beta^{D}_{n,i}) / k^2 \right)^{.5}$$

where k is the number of sample firms. Standard errors of the average bank and lower grade debt betas are calculated in analogously.

TABLE 8
DIRECT LOW GRADE DEBT BETA ESTIMATES

Market model and Scholes-Williams debt betas calculated directly from weekly bond prices compared to implicit betas for all debt and for lower grade debt calculated from equity betas for eight leveraged recapitalizations completed 1985 to 1988.

Company	Direct Beta Estimates				Implicit Beta Estimates			
	Market Model Beta of Bond[a]	Scholes-Williams Beta of Bond[a]	Std. Error of Market Model Estimates[a]	N (Weeks)	Constant Asset Beta		Reduced Asset Beta	
					All Debt[b]	Lower Grade[c]	All Debt[d]	Lower Grade[e]
1. Colt Industries	0.30	0.19	0.11	26	0.44	0.59	0.26	0.34
2. FMC	0.26	0.20	0.07	26	0.66	0.90	0.57	0.77
3. Fruehauf	0.18	0.87	0.13	26	0.46	0.65	0.29	0.40
4. Holiday	0.30	0.59	0.11	26	0.29	0.35	0.23	0.28
5. Interco	-0.21	0.00	0.27	25	0.59	0.82	0.39	0.54
6. Kroger	0.24	0.41	0.16	21	0.89	1.26	0.55	0.77
7. Owens Corning Fiberglas	0.32	0.55	0.09	26	0.65	0.84	0.38	0.49
8. USG	0.30	0.47	0.09	26	0.85	1.16	0.55	0.75
Average	0.21	0.41	0.05		0.60	0.82	0.40	0.54
Median	0.28	0.44			0.62	0.83	0.39	0.52

[a] Market model debt betas calculated using the market model and the value-weighted index from one week to 26 weeks (when possible) after the recapitalization is completed. Standard errors are for beta estimates from market model regressions. Scholes-Williams betas calculated according to Scholes-Williams (1977), using weekly returns and the value-weighted index. Weekly bond prices are desk prices for lower grade bonds for eight recapitalizations provided by Morgan Stanley.

[b] Same as implicit beta on all post-recapitalization debt, β^D_n presented in panel A of Table 4. β^D_n assumes the post-recapitalization asset beta, β^A_n, equals the pre-recapitalization asset beta. β^D_n is calculated as:

$$\beta^D_n = \frac{[E_n + D_n]}{D_n}[\beta^A_o - \beta^E_n \cdot \frac{E_n}{E_n + D_n}]$$

where pre-recapitalization asset betas, β^A_o, equal:

$$\beta^A_o = \beta^E_o \frac{E_o}{E_o + D_o} + \beta^D_o \frac{D_o}{E_o + D_o}$$

[c] Assumes that lower grade debt has twice the systematic risk of bank debt for the constant asset beta case.

[d] Same as implicit beta on all post-recapitalization debt, β^D_n presented in panel B of Table 4. β^D_n assumes the market-adjusted premium to public shareholders represents a reduction in fixed costs which reduces the post-recapitalization asset beta, β^A_n, relative to the pre-recapitalization asset beta. β^D_n is calculated as:

$$\beta^D_n = \frac{[E_n + D_n]}{D_n}[\beta^{A*}_o - \beta^E_n \cdot \frac{E_n}{E_n + D_n}]$$

where pre-recapitalization asset betas adjusted for reduction in fixed costs, β^{A*}_o, equal:

$$\beta^{A*}_o = [\beta^E_o \frac{E_o}{E_o + D_o} + \beta^D_o \frac{D_o}{E_o + D_o}] \cdot [\frac{E_o + D_o + Mkt_o}{E_n + D_n}]$$

[e] Assumes that lower grade debt has twice the systematic risk of bank debt for the reduced asset beta case.