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The Review of Financial Studies, Volume 6, Issue 4 (Winter, 1993), 959-982.

Stable URL:
http://links.jstor.org/sici?sici=0893-9454%28199324%296%3A4%3C959%3ABLILB%3E2.0.CO%3B2-R

Bondholder Losses in Leveraged Buyouts

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Announcements of successful leveraged buyouts (LBOs) during January 1985 to April 1989 caused a significantly negative return on outstanding publicly traded nonconvertible bonds. Yet the average risk-adjusted debt holder losses are less than 7 percent of the average risk-adjusted equity holder gains. Bond losses are related to the pre-LBO rating, but only weakly to equity holder gains. We demonstrate that trader-quoted data from a major investment bank offers conclusions about the effects of LBOs on debt holders different from those drawn from commonly used matrix and exchange-based data (such as Standard & Poor's Bond Guide data). This has important implications for event studies involving debt instruments.

The effect of leveraged buyouts (LBOs) on the wealth of target shareholders has received extensive study.

We wish to thank an anonymous referee, Ed Altman (a referee), Paul Asquith, Bernard Black, Michael Brenan, David Hirshleifer, Gailen Hite, Laurentius Marais, Annette Poulsen, Matthew Spiegel, Richard Sweeney, Sheridan Titman, and especially both the Editor Stephen Brown and Managing Editor Chester Spatt for helpful comments. Seminar participants at New York University, Columbia University, Georgetown University, Loyola University of Chicago, University of Missouri–Columbia, University of North Carolina–Chapel Hill, University of Texas–Austin, Pennsylvania State University, University of Iowa, University of Wisconsin–Milwaukee, and Rutgers University provided a very helpful sounding board. Advice and assistance in data collection were provided by Greg Batey, Ivan Gruhl, Bill Mast, and Walter Rosenblatt at Lehman Brothers. Greg Batey and Emmanuel Roman provided many helpful comments at the early stages of this research. Arthur Warga wishes to thank Howard Clark, Jr., for his grant supporting this and other research. Address correspondence to Arthur Warga, School of Business Administration, University of Wisconsin–Milwaukee, 640 Bolton Hall, Milwaukee, WI 53201.

The Review of Financial Studies Winter 1993 Vol. 6, No. 4, pp. 959–982

The consensus of past work has been that equity holders receive substantial gains. There is considerably less agreement of the effect of LBOs on the wealth of target bondholders due to the lack of high-quality corporate bond data. By focusing on the issue of bond data sources, we demonstrate that studies that measure the timing and magnitude of security price reaction to recent information (e.g., LBO announcements) can be sensitive to the type of data that is used. We find that LBOs cause real bondholder losses and that the main effect is concentrated at the time of the LBO announcement.

Unfortunately, high-quality bond data are not always available. Most bond trading is carried out in the dealer market where prices are proprietary. Publicly available data, such as that produced by bond trades on the New York Stock Exchange, can be inadequate because these markets are extremely thin. Bond prices from commercial services that purport to be based on the dealer market are usually tied to an algorithm that does not always incorporate recent information. Although Warga (1991) finds that dealer and exchange-based data sources provide similar prices for large portfolios under normal circumstances, this article shows that high-volume dealer market prices can show important differences in event studies. We find that our dealer market yields react not only sooner than exchange-based yields, but they also show statistically and economically more significant effects. For example, in a current study on LBOs that relies on the S&P bond data, Asquith and Wizman (1990) find an average four-month LBO risk-adjusted announcement bondholder return of −3.2 percent. In contrast, we document equivalent returns of −6.5 to −7.3 percent in the set of overlapping bonds for which the Asquith and Wizman data suggests a −3.8 percent return. Moreover, if we either properly aggregate returns among correlated bonds or if we exclude R.J.R. Nabisco, the S&P data (unlike the trader-quoted data used in this paper) no longer suggest a significant loss of bondholder wealth.

Of course, the effect of LBOs on the wealth of bondholders is an interesting issue in its own right and must be addressed to determine the effect of LBOs on total firm value. It has been suggested in academic studies [e.g., Shleifer and Summers (1988)], as well as in the popular press, that the gains obtained by stockholders may be largely at the expense of bondholders; that is, net firm value may not change significantly. Counter to this argument are claims that improvements in operating efficiency or tax advantages [e.g., Jensen (1986)] may increase the firm's total value and thus leave bondholders without any losses or, possibly, even with gains.

Using exchange data collected from the *Wall Street Journal*, Lehn and Poulsen (1988) and Marais, Schipper, and Smith (1989) first examined the effect of LBOs on the price performance of outstanding senior securities. Lehn and Poulsen find that in the 1980–1984 period, nine publicly traded, nonconvertible bonds issued by eight companies experienced only minimal price changes in the 10–20 day period before and after the leveraged buyout announcements. Marais, Schipper, and Smith examined price changes around LBO announcements for about 50 publicly traded nonconvertible bonds issued by about 30 firms from 1974 through 1985, and also found that public nonconvertible debt experienced only minimal price effects.[1]

There are two reasons why it is surprising that this earlier literature has found that bondholder prices do not decline in LBOs. First, the bond ratings of firms involved in LBOs are usually significantly downgraded. Second, both Lehn and Poulsen and Marais, Schipper, and Smith reported that leverage ratios triple on average. Higher leverage can reduce the value of outstanding equity both by increasing the probability and the deadweight costs of a possible future bankruptcy and by reordering the priority of claims in bankruptcy. It is well known that if an outstanding bond is not fully protected by seniority covenants, an increase in leverage reduces its value.[2] Even if a bond has extensive covenants and/or explicit seniority, Franks and Torous (1989) argued that it is unlikely that bankruptcy courts would uphold them. Therefore, even if a bond has priority covenants that prevent the firm from issuing bonds of equal or higher seniority, these priority rules are probably not completely upheld in the case of financial distress. Eberhart, Moore, and Roenfeldt (1990) confirmed this conjecture.[3] They found partial, but far from complete, adherence to priority rules. In their sample of 30 bankruptcy filings, shareholders receive an average of 7.6 percent in excess of that which they would have received under the absolute priority rules in debt covenants. Thus, unless the increase in leverage produces efficiency gains large enough to offset added bankruptcy costs or reduced effective priority, bonds would probably experience negative returns in LBOs. Moreover, according to Marais, Schipper, and Smith, Moody's Bond Record indicates widespread rating downgradings but no upgradings of nonconvertible debt in their sample, presumably indicating that bond prices should be adversely affected.[4]

[1] Altman (1991) provides a comprehensive study of bond downgradings in the 1984–1988 period and finds little negative impact on bond prices in the subset of firms whose downgradings result from event risk (many of which are LBOs appearing in our sample) in a two-month period leading up to the downgrading date. Our conclusion that LBOs cause real bondholder losses may differ not only because we use different data but also because our event date is not the downgrading but the LBO announcement date.

[2] For a detailed discussion of bond covenants, see Smith and Warner (1979).

[3] A more recent paper by Weiss (1991) also provides evidence of substantial priority violations.

[4] Crabbe (1991) documents the introduction of "poison put" covenants into debt issues beginning in 1988 as a response to losses suffered by bondholders in firms undergoing major capital restruc-

This article extends past studies of bondholder wealth changes in LBOs in the 1985–1989 period. We use a data set—consisting exclusively of trader-quoted prices—that was unavailable in previous studies. In contrast to earlier studies, we find that nonconvertible bondholders experience significant wealth losses in LBOs. These negative bond price reactions to LBO announcements are significantly related to the ex ante bond rating and time to maturity. Further, although we find some weak evidence that firms with larger debtholder losses experience higher equity holder gains, we do not find that expropriation of bondholder wealth is a major source of stockholder gains in LBOs, as suggested, for example, in Shleifer and Summers (1988). When we extrapolate the average negative bond price reaction for a company's public nonconvertible debt to the entire debt of the company (long-term debt and debt in current liabilities, as reported in COMPUSTAT), we find that, on average, the total risk-adjusted firm value change is still positive. The debt holder losses can at best account for a small percentage (around 6 percent risk adjusted) of the equity gain.[5]

We proceed as follows. In Section 1, we discuss and contrast our trader-quoted bond price data to both exchange-based and matrix-based bond price data. Section 2 analyzes both the time series and cross section of bond and equity characteristics and returns, and investigates the hypothesis that equity holders expropriate wealth from bondholders. Section 3 reports results of cross-sectional regressions that test whether pre-LBO announcement bond rating, time to maturity, and capital structure contain information about post-LBO bondholder wealth effects. Section 4 concludes.

1. Bond Pricing Issues

1.1 Available bond data

As described in Warga (1991), the acquisition of accurate historical corporate bond price data poses a major challenge for research in this area. The two sources of generally available price quotes are exchange prices (e.g., New York or American Stock Exchanges) and institutional prices from major over-the-counter bond dealers (e.g., Merril Lynch). Exchange prices reflect primarily the odd-lot activities of individual investors (10 bonds or less per transaction) and cover only a limited number of corporate issues and a negligible portion

turings. Crabbe's study measured losses over significantly longer time periods and is not concerned with the timing of the reaction to news of a restructuring.

[5] This may not be too surprising, since Altman (1987) documents that even in defaults, bonds lose only 40 percent. Kaplan (1989) documents a 40 percent equity gain in LBOs, and large U.S. companies typically have more equity than debt in their capital structures.

of the total trading. For example, of the 37 bonds in Lehn and Poulsen, exchange price quotes are available for only 13 bonds by 12 companies (9 nonconvertibles, 4 convertibles).[6]

Institutional data is more comprehensive than exchange data. It covers a larger number of bonds, offering prices at which large positions could have been or indeed were transacted. Unfortunately, all studies known to us which use institutional prices use data from the Merrill Lynch Bond Price Service (often obtained indirectly through services such as Data Resources Incorporated or Bloomberg Financial Markets).[7] These prices are not trader quotes but algorithmically determined "matrix" prices. The algorithms consist of rules that specify the addition of a fixed spread over either an actively traded benchmark issue of the same company, another company's issue with similar rating, maturity, and coupon, or a U.S. Treasury issue.

Several commercial bond pricing services provide a mix of exchange and matrix prices, and prominent among these are Standard & Poor's and Moody's. Both of these services prioritize their data sources by always putting in exchange transactions as the reported prices when they are available. We will henceforth refer to these services as exchange based. Because exchange transactions are rare, exchange-based data services rely heavily on matrix prices. Until recently, matrix prices employed by S&P and Moody's were created by Interactive Data Corporation (IDC). IDC supplies data to S&P and Moody's and, for exchange-listed bonds, fills in missing data with bid prices from the exchange if the nontrading period is less than a week.[8] If a bond does not trade for a week or more, IDC fills in the data series with either an institutionally based matrix bid price or a dealer bid quote. IDC therefore mixes odd-lot exchange data and institutional data in a single series. If a bond is not exchange listed (and most are not), then all prices are matrix based.[9]

Figure 1 illustrates a case where transactions-based yields are not available. In October 1986 Lear Siegler announced a leveraged buyout. S&P provided the yields plotted in Figure 1 in the year surrounding this event for an 11.75 percent coupon bond maturing October

[6] Of the 92 LBOs they studied, 68 firms, or nearly three-quarters of their sample, did not have listed bonds outstanding. Moreover, Lehn and Poulsen's largest event window was 20 days before and after the LBO announcement. Their sample would have been further reduced if they had investigated post-LBO bond performance more than a month after or before the event (as we do in this article).

[7] See Nunn, Hill, and Schneeweis (1986) for references to articles employing institutional prices from Merrill Lynch. Their article also contains additional details on exchange prices.

[8] On rare occasions, IDC will supply an ask price if no bid price is available.

[9] According to S&P, matrix prices are now calculated in house for certain issues. During the period covered in this study, IDC was the primary source of matrix prices. Occasionally, IDC uses dealer quotes in its matrix prices, but these dealer quotes represent a small percentage of IDC prices because of the large number of bonds they cover.

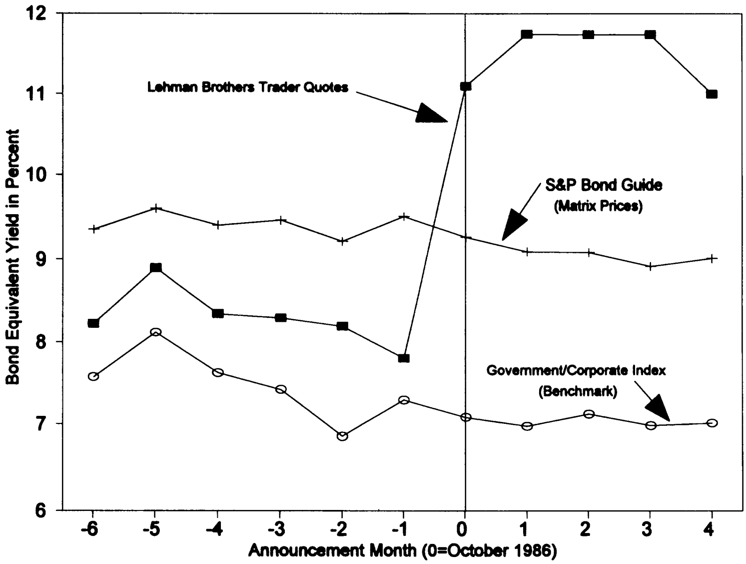

Figure 1
Yield reaction around Lear Siegler LBO announcement for 11¾ percent bond of 10/91
The Government/Corporate Index benchmark series combines Lehman Brothers Government and Corporate Bond Indexes. The Corporate Bond Index includes all public, fixed-rate, nonconvertible investment-grade debt. The Government Bond Index includes all U.S. Government guaranteed bonds and notes excluding flower bonds and foreign-targeted issues. Bonds must have a minimum outstanding principal of $25 million and a minimum maturity of one year to quality for any Lehman Brothers bond index.

1991. We collected in-house trader-quoted bid yields from Lehman Brothers (further described in Section B) around this event to match with the S&P yields, and both series are plotted. We also provide the yields to Lehman Brothers' combined Intermediate Term Corporate/Government Bond Index, which is a commonly used benchmark for gauging bond market performance. Although we are not privy to the exact index or bond that IDC uses to matrix price the Lear Siegler bond, it appears that the bond's matrix-based prices track the Lehman Brothers Corporate/Government Index fairly well. The S&P data exhibit virtually no change around the event, whereas the trader-quoted yields from Lehman Brothers indicate a 200-basis-point increase in yield (and a corresponding decrease in the price Lehman Brothers was willing to pay for the bond). It is the absence of independent movement in the S&P data at the LBO announcement date that suggests the prices reported for the bond by S&P (and created by IDC) are just fixed spreads off of some index or more actively traded U.S. Treasury issue.

In an article on corporate buyouts, Asquith and Wizman (1990) found that 46 bonds of companies involved in successful LBOs have an average risk-adjusted return of −3.2 percent in a fourth-month event window; the subsample of 21 unprotected bonds has an average risk-adjusted return of −3.8 percent. Asquith and Wizman suggested that their event-window drop might be smaller than the risk-adjusted −6 to −7 percent returns reported in here because of differences in sample composition and covenant protection. They argued that Blume, Keim, and Patel (1991) reported that dealer market quotes and data from S&P are broadly consistent, showing a correlation of .92 between prices appearing in the Standard & Poor's Guide and Drexel's and Salomon's quoted desk prices for a broad sample of bonds. This is consistent with Warga (1991), whose central result is that, on average, across a broad sample of bonds, pricing portfolios with either dealer or exchange data (actual transactions) produces similar results. (Warga examined investment grade bonds; Blume et al. examined high-yield instruments.)

As we demonstrate now, this does not speak to the problems that come up in event studies. To examine if differences in return magnitudes are due to differences in the data source, we now compare the LBO event-window returns from the S&P Bond Guide data (used in Asquith and Wizman) with our trader-quoted return data. There are 36 bonds that appear in their sample that are also in the sample we employ here. Our full sample consists of 43 bonds issued by 16 firms (the selection process is detailed later). Since our firms were fairly large and had bonds that were traded frequently at Lehman Brothers, we believe that these bonds are among the most liquid bonds in the Asquith and Wizman sample.

Table 1 provides average unadjusted and risk-adjusted event-window returns for the 36 bonds from 13 companies that are common to both Asquith and Wizman (1991) and this study. For valid statistical inference (described with our data and methods), the returns have to be first averaged within firms and then across all firms.[10] Our event window is identical to Asquith and Wizman's (1990). Panel A of the table shows that S&P Bond Guide data produces a statistically significant risk-adjusted event-window drop (of 3.83 percent) only if RJR is included and if different bonds of a company are considered to be independent observations. When either RJR is excluded from the sample (panel B) or bonds of the same company are first properly aggregated (to one bond/firm), the average bond price only drops between 1.70 and 0.93 percent and becomes statistically insignificant. Furthermore, most of the risk-adjusted bond price drops were caused by increases in the risk-adjustment benchmark. Unadjusted S&P returns

[10] On the LBO announcement dates, 14 of the 36 bonds were exchange-listed (all on the New York Stock Exchange).

Table 1
Returns from four-month event window for both trader-quote data and S&P bond guide data

	Trader quote		S&P bond guide	
	DTRET	DTRETR	DTRET	DTRETR
		A: With RJR Nabisco bonds		
		One bond/firm, $N = 13$		
Mean	−2.75%	−6.55%	2.03%	−1.70%
	(−1.06)	(−2.78)	(1.74)	(−1.17)
		All Bonds, $N = 36$		
Mean	−4.60%	−7.33%	−1.10%	−3.83%
	(−3.65)	(−5.62)	(−1.14)	(−3.25)
		B: Without RJR Nabisco bonds		
		One bond/firm, $N = 12$		
Mean	−2.32%	−6.18%	2.63%	−1.14%
	(−0.84)	(−2.44)	(2.45)	(−0.78)
		All bonds, $N = 22$		
Mean	−2.50%	−5.00%	1.55%	−0.93%
	(−1.41)	(−2.80)	(1.38)	(−0.62)

t-statistics are in parentheses below the coefficients. The 36 bonds from 13 companies examined here represent all bonds traded at Lehman Brothers over the period January 1985 through April 1989 that have both a consecutive time series of dealer quotes available and prices reported in the S&P Bond Guide around the month of the buyout announcement. Risk-adjusted bond returns (DTRETR) are calculated by subtracting from the raw bond return (DTRET) the return of an index with rating and maturity characteristics similar to the bond of interest. The "adjustment" index was constructed from eight Lehman Brothers Corporate Bond indexes by linear interpolation of the two closest indexes in the dimensions of rating and maturity (again, bonds outside the available range of characteristics are benchmarked against the closest index). Under the null hypothesis that LBOs had no effect, the average risk-adjusted debt return should be zero. The event-window returns are calculated from the month-end two months preceding an LBO announcement to the end of the second month following it. For example, if the LBO announcement is March 20, the returns are calculated over February, March, April, and May. One bond/firm means that values are averaged first within firm and then across firms. Trader-quote data are from Lehman Brothers, and exchange-based data are from the S&P Bond Guide.

are at best statistically insignificantly negative, at worst statistically significantly *positive*. In contrast, in this article the risk-adjusted trader-quoted return drops are considerably larger, ranging from 5.00 to 7.30 percent, and always statistically significant. Even unadjusted returns are always negative, ranging from −2.32 to −4.60 percent, although the unadjusted drops are only statistically significant when we include all 36 bonds as independent observations.

Panel B of Table 1 presents the same information as panel A but with all 14 RJR bonds excluded from the analysis. Risk-adjusted returns from trader-quote data again reveal significant losses, but none are provided by the S&P data. It is noteworthy that the only significant figure in the S&P data in panel B is a *positive* unadjusted debt return on a firm-by-firm basis.

Note that not all exchange data respond slowly. We can illustrate this with two Federated Department Store bonds that are exchange-

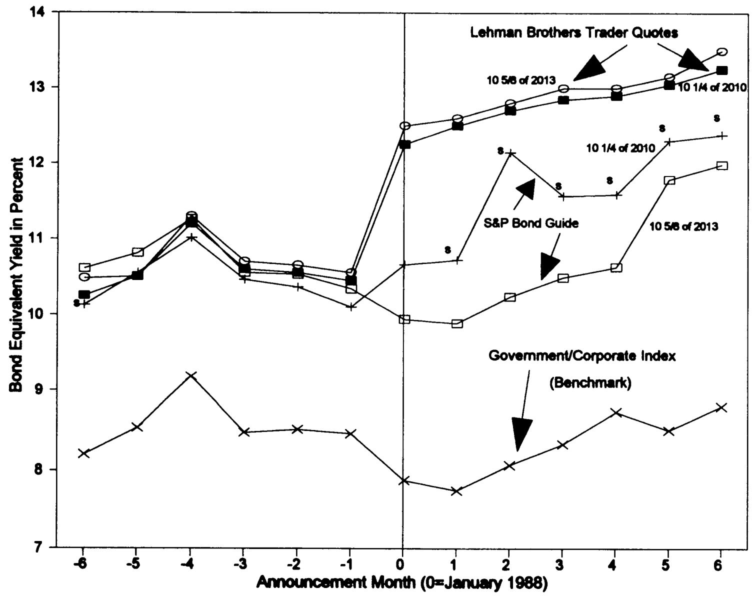

Figure 2

Yield reaction around Federated Department Stores LBO announcement for $10\frac{1}{4}$ percent bond of 2010 and $10\frac{5}{8}$ percent bond of 2013

The letter "s" next to some observations of the S&P Bond Guide's yields for the $10\frac{1}{4}$ percent bond of 2010 denotes yield is based on an actual NYSE transaction. The Government/Corporate Index benchmark series combines Lehman Brothers Government and Corporate Bond Indexes. The Corporate Bond Index includes all public, fixed-rate, nonconvertible investment-grade debt. The Government Bond Index includes all U.S. Government guaranteed bonds and notes excluding flower bonds and foreign-targeted issues. Bonds must have a minimum outstanding principal of $25 million and a minimum maturity of one year to qualify for any Lehman Brothers' bond index.

traded and appear in both samples. In Figure 2, we plot the S&P yields along with our trader-quote yields for a 10.25 percent coupon bond maturing in 2010 and a 10.625 percent coupon bond maturing in 2013. Until the month of the LBO announcement (January 1988), all series track fairly close to one another. At the announcement date, both sets of trader-quote yields as well as the S&P Bond Guide yields for the 10.25 percent bond increase. S&P bond yields for the 10.625 percent coupon bond failed to respond to the LBO announcement and continue to track the Lehman Brothers Intermediate Term Government/Corporate Index for several more months.

The reason one of the S&P yield plots appears to react to the LBO announcement in a timely fashion and the other does not is that one bond is priced off exchange bids and actual exchange transactions, whereas the other is matrix priced. We denote by "s" in Figure 2 those yields that are calculated from actual transactions on the New York exchange. The 10.25 percent Federated bond was more actively traded than its sister bond. In fact, the 10.625 percent bond never had a single transaction in the LBO and post-LBO period (on any day, not just month end.) IDC supplied matrix prices were the only prices S&P had available to publish for the 10.625 percent bond.[11]

1.2 Our bond price data set

We set out by creating a comprehensive list of all leveraged buyouts from January 1985 to April 1989 from LBO classifications at both Goldman Sachs and Lehman Brothers. Because Lehman Brothers and Goldman Sachs are both major traders of corporate bonds, it is unlikely that many LBOs are missing from our sample.[12] From this list, we then identified 29 firms with 116 bonds in the Lehman Brothers historical corporate bond data base. This list included virtually all LBO companies with publicly traded, nonconvertible debt issues in our sample period. Finally, we follow Sarig and Warga (1989) by eliminating bonds that did not have a consecutive time series of exclusively trader-quoted returns around the announcement period.[13] Thus, each return used in this study was quoted by the Lehman Brothers trader responsible for the bond. This produced a final list of 43 bonds issued by 16 companies, admittedly a *biased* sample of large firms (with liquid bonds) that ex post successfully underwent LBOs. Table 2 lists our firms along with the individual bond cusips, maturity dates, coupons, and event dates.

1.3 Return adjustment techniques

To compensate Lehman Brothers' bond returns for contemporaneous market movements, we created risk- and maturity-adjusted bond return series (henceforth abbreviated to "risk-adjusted" returns).[14] Risk-adjusted bond returns were calculated by subtracting from the raw bond return the return of an index with rating and maturity characteristics similar to the bond of interest. Under the null hypothesis

[11] Using exclusively exchange data, Cook and Martin (1991) find some negative wealth effects to bondholders in a sample of eight takeovers. These eight takeovers represent their subset of firms that traded on the exchange in a short interval around the announcement date and that experienced leverage increases of at least 50 percent (based on book values).

[12] After carrying out our analysis, we discovered that two of the companies in our sample (FMC and Owens Corning) did not subsequently go private but continued trading on the New York Stock Exchange. They may more properly be labeled as "leveraged recapitalizations" than leveraged buyouts. Yet, since both were categorized as LBOs by at least one of these two investment banks, we have retained them in our sample.

[13] Trader-quoted bid prices represent commitments to purchase at least 100 bonds (a round lot) and can coincide with an actual trade price if a trade occurred near the end of the day. Traders are not required to supply quotes if they have not made a trade recently. In this case, Lehman Brothers computes a matrix price (excluded in our data base) based on a proprietary algorithm.

[14] We avoid risk-adjustment procedures for bonds that require calculating a parameter like beta. When employing monthly bond returns (as we do), calculating beta is problematic because salient bond characteristics (e.g., maturity, variance) can change substantially over the number of periods (more than a year) necessary to use for parameter estimation.

Table 2
Publicly traded nonconvertible LBO debt securities in our sample

CUSIP	Issuer	Event date	Maturity date	Coupon
1 019519AE	Allied Stores	09/04/1986	05/15/1992	6.000
2 077851AA	Bell & Howell	11/25/1987	07/01/1996	8.875
3 099725AD	Borg Warner	10/31/1986	04/01/1996	8.000
4 121691AA	Burlington Ind	04/27/1987	07/15/1990	4.750
121691AC	Burlington Ind	04/27/1987	08/15/1995	9.000
121691AD	Burlington Ind	04/27/1987	08/01/1990	11.250
5 196864AC	Colt Ind.	03/11/1988	10/15/2001	12.500
6 302491AC	FMC Corp	02/22/1986	10/01/2001	7.500
302491AE	FMC Corp	02/22/1986	01/15/2000	9.500
7 314099AC	Federated Dept	01/22/1988	06/15/2010	10.250
314099AE	Federated Dept	01/22/1988	05/01/2013	10.625
314099AJ	Federated Dept	01/22/1988	12/15/1996	7.875
314099AK	Federated Dept	01/22/1988	11/01/1992	9.375
8 859370AD	Fruehauf Corp	03/27/1986	02/15/1996	9.750
9 521894AD	Lear Siegler	10/30/1986	10/21/1991	11.750
10 522066AC	Leaseway Transp	11/14/1986	03/15/1989	12.500
11 597715AC	Midland Ross	06/10/1986	02/15/2007	6.000
12 629527AA	Nabisco	10/21/1988	05/01/2001	7.750
74960LAC	RJR Nabisco	10/21/1988	01/15/2007	8.000
74960LAD	RJR Nabisco	10/21/1988	02/01/2017	8.375
74960LAE	RJR Nabisco	10/21/1988	03/15/2017	8.625
74960LAG	RJR Nabisco	10/21/1988	01/15/1995	8.875
74960LAH	RJR Nabisco	10/21/1988	02/15/1996	8.625
74960LAJ	RJR Nabisco	10/21/1988	03/01/1998	8.875
74960LAK	RJR Nabisco	10/21/1988	04/15/1991	8.125
74960LAL	RJR Nabisco	10/21/1988	05/01/1995	9.250
74960LAM	RJR Nabisco	10/21/1988	11/15/1992	8.875
761753AK	Reynolds RJ Ind	10/21/1988	08/01/1993	10.750
761753AM	Reynolds RJ Ind	10/21/1988	04/01/2016	9.375
761753AQ	Reynolds RJ Ind	10/21/1988	04/15/1989	6.875
761831AD	Reynolds RJ Tob	10/21/1988	09/01/1994	7.875
13 690734AC	Owens Corning	08/27/1986	05/01/2010	12.000
690734AD	Owens Corning	08/27/1986	12/15/2005	9.500
14 690768AB	Owens Illinois	12/12/1986	04/01/2001	7.625
690768AE	Owens Illinois	12/12/1986	11/01/1999	9.350
15 761338AA	Revco D.S.	03/17/1986	08/15/2015	11.750
761338AB	Revco D.S.	03/17/1986	10/01/1995	11.125
16 933169AE	Walter Jim Corp	07/17/1987	02/01/1997	7.875
933169AG	Walter Jim Corp	07/17/1987	02/01/1996	9.500
933169AJ	Walter Jim Corp	07/17/1987	02/01/1993	13.125
933169AM	Walter Jim Corp	07/17/1987	01/15/2005	13.250
933169AN	Walter Jim Corp	07/17/1987	01/15/2006	11.000
933169AP	Walter Jim Corp	07/17/1987	04/01/2016	9.500

The 43 bonds listed here represent all bonds traded at Lehman Brothers over the period January 1985 through April 1989 that were issued by firms involved in a leveraged buyout and that had a consecutive time series of dealer quotes available around the month of the buyout announcement.

that LBOs had no effect, the average risk-adjusted debt return should be zero. The Appendix describes the methods of adjusting returns in greater detail.

1.4 Additional data

We obtained unadjusted and market-model-adjusted equity returns from CRSP's daily NYSE-AMEX file (all our firms were traded at the NYSE before their LBO). The market model uses the value-weighted market index and is calculated with daily data. [Our results are invariant to including a second industry portfolio in the market model, to using a Scholes–Williams (1977) adjustment, and to freezing or floating the beta-calculation window with each month. The precise method of adjusting equity returns is described in the Appendix.] Additional data, such as firms' capital structure or bond ratings, were either hand-collected or read from the COMPUSTAT or the Lehman Brothers database.[15]

2. Bondholder Wealth Losses

2.1 Changes in capital structure

Table 3 describes the capital structure changes that our LBO firms undergo, as obtained from the COMPUSTAT data base. We find that these firms typically at least triple both their long-term liabilities and their debt in current liabilities.[16] Except for Colt Industries,[17] the leverage increases are large by any measure.

An increase in a firm's leverage need not imply that outstanding bondholders necessarily lose wealth. According to Kim, McConnell, and Greenwood (1977), bonds can be protected against future issues with priority covenants (which prevent issuance of debt of equal or higher priority or shorter duration/maturity). However, Franks and Torous (1989) document that bond covenants are not likely to protect bondholders in case of financial distress.[18] In their sample, bankruptcy proceedings stretch over three and one-half years, indicating that bankruptcies can be quite costly. They also show that deviations from absolute priority are the rule rather than the exception. Thus, since seniority rules for bonds that continue to be outstanding are not ex ante enforceable, it is likely that leverage increases produce wealth losses. Moreover, none of the bonds in our sample had explicit put or conversion features.

2.2 Changes in bond characteristics

The changes in capital structure are accompanied by the expected downgradings in debt ratings for the bonds. When ranked on a scale

[15] We neither excluded any bonds from our sample because of missing information on CRSP and/ or COMPUSTAT, nor were any of our bonds retired during or immediately after the LBO. Only one Leaseway bond was defeased several months after our event window.

[16] Because of missing data, the number of entries is different in the ex ante and ex post columns. Thus, the difference in means should not be used to take the ratio of ex ante and ex post means.

[17] Colt experienced a leveraged recapitalization a year before the LBO announcement. (Nevertheless, Table 4 indicates that Colt's bondholders suffered substantial losses.)

[18] See also Eberhart, Moore, and Roenfeldt (1990) and Weiss (1991).

Table 3
Capital structure changes

Name	LTDEBT1	LTDEBT2	CRDEBT1	CRDEBT2	EQSIZE1
Allied Stores	664.10	2,910.34	40.661	1,301.04	1,538.65
Bell & Howell	145.87	487.88	15.875	33.96	262.88
Borg Warner	332.50	3,641.60	105.400	108.30	3,268.27
Burlington Industries	392.33	2,262.37	76.277	694.93	1,139.92
Colt Industries	·	·	·	·	·
FMC Corp	303.21	1,787.31	67.684	72.98	1,683.35
Federated Department	956.62	·	399.646	·	2,909.44
Fruehauf	544.42	780.10	21.629	6.28	483.33
Lear Siegler	283.87	·	14.480	·	888.81
Leaseway Transportation	192.64	572.29	150.853	26.49	464.89
Midland Ross	179.14	·	30.436	·	250.61
Owens Corning	543.02	1,645.19	33.369	823.91	1,117.46
Owens Illinois	576.60	3,021.70	161.100	315.80	3,187.10
RJR Nabisco	3,884.00	·	604.000	·	11,131.06
Revco D.S.	304.88	1,154.86	4.490	144.14	826.56
Walter Jim	860.18	·	13.024	·	1,498.96

Variable	*N*	Minimum	Maximum	Mean	Std dev	*t*-statistic for the mean
LTDEBT1	15	145.873	3,884.00	677.56	919.60	(2.85)
LTDEBT2	10	487.880	3,641.60	1,826.36	1,107.21	(5.22)
CRDEBT1	15	4.490	604.00	115.93	168.60	(2.66)
CRDEBT2	10	6.281	1,301.04	352.97	440.73	(2.53)
EQSIZE1	15	250.609	11,131.06	2,043.42	2,707.43	(2.92)

The 16 companies listed here represent firms that were involved in a leveraged buyout over the period January 1985 through April 1989 and whose bonds had a consecutive time series of dealer quotes at Lehman Brothers available around the month of the buyout announcement. LTDEBT1 = long-term debt before LBO, LTDEBT2 = long-term debt after LBO, CRDEBT1 = current debt before LBO, CRDEBT2 = current debt after LBO, EQSIZE1 = equity before LBO, (·) denotes missing. All numbers are in millions of dollars.

of 2 to 20 (2 for "AAA," to 16 for "CCC," and 20 for a bond that is not rated by Standard & Poor's), the average bond rating across firms before the LBO was about 8 (corresponding to an A−) with a standard deviation of 2.2. After the LBO, this average dropped to 15.2. No firm retained a rating higher than a 15 (B+), and two firms lost their S&P ratings altogether. Consistent with Weinstein (1977), the bond rating changes convey information that has long been reflected in bond prices. On average, the S&P ratings changed five months after the LBO announcement.

We now turn our attention toward the observed returns in LBOs. Figures 3–4 plot the time series of returns from 12 months before to 8 months after the LBO announcement. The plots end in month 8 because only one firm's equity continues to trade after this month. Figure 3 presents the risk-adjusted cumulative debt returns, and, for perspective, Figure 4 plots risk-adjusted cumulative returns for both debt and equity. These returns are first averaged within firm and then

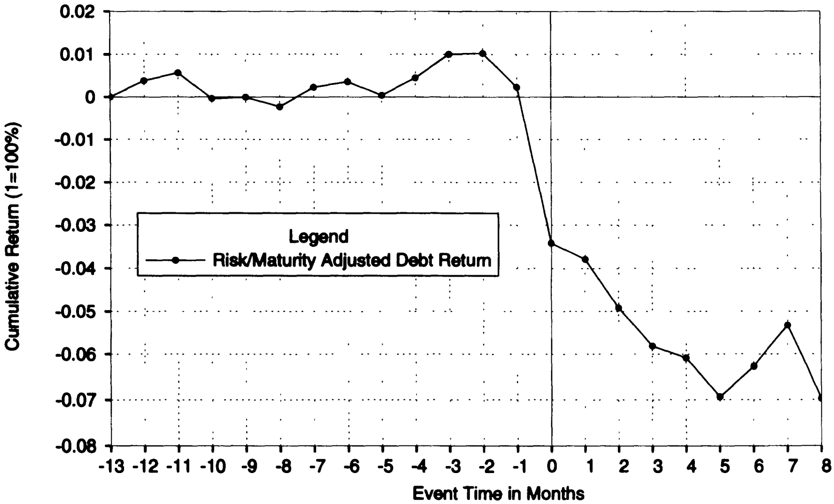

Figure 3
Cumulative risk- and maturity-adjusted debt returns around the LBO announcement for 16 firms from January 1985 to April 1989
Debt returns are computed from trader-quoted Lehman Brothers prices. Each return was adjusted by subtracting the return of an equivalent bond index that matches bond risk (rating) and maturity. The index was constructed from eight Shearson Lehman indexes that contain only publicly-traded, fixed-rate debt. Plotted returns were first averaged across all bonds within each firm and then across firms.

across firms each month, and then cumulated over time.[19] Since non-LBO bonds of similar maturity and risk gained on average in our sample period, unadjusted bond returns were significantly higher than properly risk-and maturity-adjusted returns.

Table 4 lists the bond and stock returns for each firm from one month before to two months after the LBO announcement date.[20] The returns are summarized in two ways. First, we average the returns of all bonds within each company, and then report results by companies (to avoid overweighting firms with many bonds). Second, we report results obtained by averaging *all* individual bonds. The *t*-statistics for the second method are biased upward by the strong correlations among the bonds of the same company. Table 4 indicates that risk-adjusted debt returns are about −6 percent, and that risk-adjusted equity returns are about 36 percent. [Our equity returns seem high. However, although our equity sample is based on only 16 ex post successful LBOs with unusually liquid bonds, further investigation revealed that 12 other LBOs which did not satisfy our bond liquidity

[19] The Appendix discusses how this measure differs from the standard abnormal performance index (API).

[20] As indicated by the number of observations (16) in Table 4, all firms are represented in the event window.

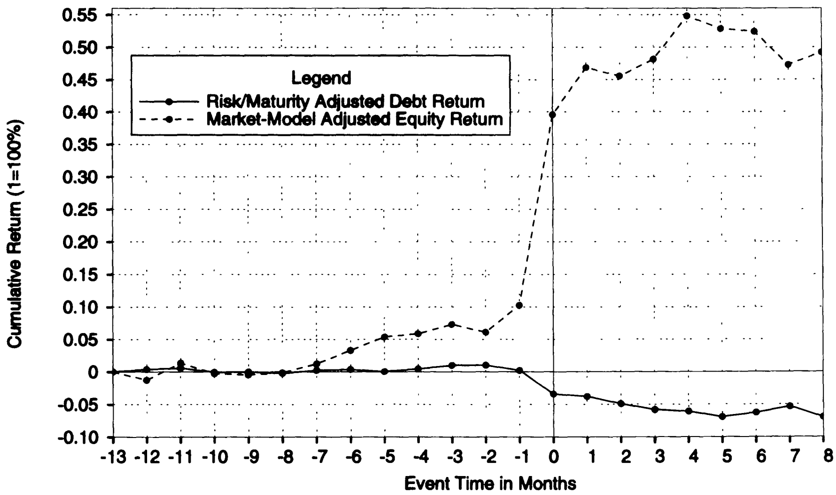

Figure 4
Cumulative market-model-adjusted equity returns and risk- and maturity-adjusted debt returns around the LBO announcement for 16 firms from January 1985 to April 1989
(Except for scale, debt returns in Figures 3 and 4 are identical.) Debt returns are computed from trader-quoted Lehman Brothers prices. Each return was adjusted by subtracting the return of an equivalent bond index that matches bond risk (rating) and maturity. The index was constructed from eight Shearson Lehman indexes that contain only publicly-traded, fixed-rate debt. Plotted returns were first averaged across all bonds within each firm and then across firms.

Table 4
Returns from four-month event window

Variable	*N*	Minimum	Maximum	Mean	Std Dev	*t*-Statistic for the mean
			A: One bond/firm			
DTRET	16	−23.0974%	10.2328%	−1.8816%	8.57%	(−0.88)
DTRETR	16	−25.3344%	2.7848%	−5.9119%	7.53%	(−3.14)
EQRET	16	−13.5879%	143.493%	47.684%	35.64%	(5.35)
EQRETM	16	−6.45510%	90.046%	36.294%	27.63%	(5.25)
			B: All Bonds			
DTRET	43	−23.0974%	10.2328%	−3.6702%	7.43%	(−3.24)
DTRETR	43	−25.3344%	4.8667%	−6.7314%	7.47%	(−5.91)

The 43 bonds represent all bonds traded at Lehman Brothers over the period January 1985 through April 1989 that were issued by firms involved in a leveraged buyout and which had a consecutive time series of dealer quotes available around the month of the buyout announcement. To compensate for contemporaneous market movements, we created risk- and maturity-adjusted bond return series (DTRETR) by subtracting from the raw bond return (DTRET) the return of an index with rating and maturity characteristics similar to the bond of interest. The "adjustment" index was constructed from eight Lehman Brothers Corporate Bond indexes by linear interpolation of the two closest indexes in the dimensions of bond rating and maturity (again, bonds outside the available range of characteristics are benchmarked against the closest index). Under the null hypothesis that LBOs had no effect, the average risk-adjusted debt return should be zero. EQRET is the equity return, and EQRETM is the market-model-adjusted equity return. The event-window returns are calculated from the month-end two months preceding an LBO announcement to the end of the second month following it. For example, if the LBO announcement is March 20, the returns are calculated over February, March, April, and May. One bond/firm means that values are averaged first within firm and then across firms.

criteria show virtually identical equity returns, as do the sample firms reported in Asquith and Wizman (1991).] Both equity and debt returns are statistically significant.

In sum, we interpret our evidence to strongly favor the hypothesis that nonconvertible debt for LBO firms experienced both statistically and economically significant wealth losses. This is borne out not only by increases in leverage and downgradings in bond ratings but also by significantly negative bond returns.

2.3 The relation between stockholder gains and bondholder losses

We now examine the hypothesis that a significant fraction of the common shareholder's wealth increase is an expropriation of wealth from bondholders. We examine the wealth expropriation hypothesis in two ways: (1) we list the absolute wealth changes by applying the observed debtholder losses to all of a company's debt reported in COMPUSTAT's database, and (2) we cross-sectionally correlate shareholder gains and bondholder losses.

Table 5 reports the changes in wealth by both bondholders and equity holders. The bondholder wealth change is obtained by multiplying the bondholder returns in our data set by the total book value of debt in the company (as read from COMPUSTAT). Because we want to impute a maximum loss to all debt, including private debt for which no market value data is available, we unfortunately have to resort to assuming that the book value of debt is a good proxy for the market value of debt *before* the LBO. Equity value changes are calculated by multiplying the total market value of equity, contemporaneous in COMPUSTAT, by the returns created from CRSP data. The results are reported in both absolute-dollar terms as well as percentage terms (e.g., risk-adjusted change in debt divided by total pre-LBO announcement debt). Since our firms are very different in size, the t-statistics in Table 5 are more accurate in the "percentage changes" columns than in the "absolute dollar changes" columns.

Because we focus on the debt instruments that were most likely to have suffered losses in an LBO (at least the publicly traded ones), and because we apply these returns to all of the company's debt (including putable and current issues) we view the reported debt losses as overestimates of the losses actually suffered by all of a firm's debt holders.[21] The results are averaged first within each firm and then across firms. We focus on firm-averaged results to avoid placing excessive weight on firms with many bonds. With the exception of the raw debt change, all debt and equity (as well as firm) values

[21] Privately placed debt, for which we have no price data, is generally believed to be better protected than publicly traded debt.

Table 5
Bondholder and equity holder wealth changes during four-month event window

Name	Absolute dollar changes (millions of dollars)				Percentage changes					
	DBTCHG	DBTCHGA	EQCHG	EQCHGA	DBTCHG	DBTCHGA	EQCHG	EQCHGA	ALL	ALLA
Allied Stores	−29.2	−57.4	525.8	429.0	−4.1	−8.1	34.2	27.9	22.1	16.6
Bell & Howell	16.6	−3.7	−35.7	29.8	10.2	−2.3	−13.6	11.3	−4.5	6.1
Borg Warner	−32.8	−48.9	409.2	443.6	−7.5	−11.2	12.5	13.6	10.2	10.6
Burlington	5.6	13.0	734.2	634.6	1.2	2.8	64.4	55.7	46.0	40.3
FMC Corp	25.6	−11.7	870.5	483.9	6.9	−3.2	51.7	28.7	43.6	23.0
Federated	−119.7	−203.2	4174.8	2619.8	−8.8	−15.0	143.5	90.0	95.1	56.7
Fruehauf	−13.7	−22.6	82.3	31.7	−2.4	−4.0	17.0	6.6	6.5	0.9
Lear Siegler	−28.1	−37.4	515.4	529.5	−9.4	−12.5	58.0	59.6	41.0	41.4
Leaseway	23.2	5.8	36.6	−30.0	6.7	1.7	7.9	−6.5	7.4	−3.0
Midland Ross	−48.4	−53.1	155.1	143.7	−23.1	−25.3	61.9	57.3	23.2	19.7
Owens Corning	−8.3	−32.6	776.5	796.2	−1.4	−5.6	69.5	71.2	45.4	45.1
Owens Illinois	44.2	−3.6	1331.2	430.0	6.0	−0.5	41.8	13.5	35.0	10.9
RJR Nabisco	−353.6	−494.3	8836.4	7762.1	−7.9	−11.0	79.4	69.7	54.3	46.5
Revco D.S.	25.1	−0.1	361.9	174.8	8.1	0.0	43.8	21.1	34.1	15.4
Walter Jim	−31.7	−3.4	740.5	543.9	−3.6	−0.4	49.4	36.3	29.9	22.8
Mean	−35.0	−63.5	1301.0	1001.5	−2.0	−6.3	48.1	37.1	32.6	23.5
t-statistic	(−1.40)	(−1.89)	(2.17)	(1.97)	(−0.85)	(−3.21)	(5.05)	(5.05)	(5.18)	(4.99)

The listed firms were involved in a leveraged buyout over the period January 1985 through April 1989 and had bonds traded at Lehman Brothers with a consecutive time series of dealer quotes around the buyout announcement. The unadjusted and adjusted change in debt value is obtained by multiplying the unadjusted and adjusted (respectively) bondholder returns in our data set by the total book value of debt in the company (as read from COMPUSTAT the year before the LBO announcement). Equity value changes are calculated by multiplying the total market value of equity prior to the event window by the unadjusted and adjusted returns created from CRSP data. The results are reported in both absolute dollar terms as well as percentage terms. Since our firms are very different in size, the *t*-statistics are more appropriate in the percentage change columns than in the absolute change columns. DBTCHG = unadjusted change in debt value; DBTCHGA = maturity- and risk-adjusted change in debt value; EQCHG = change in equity value; EQCHGA = risk-adjusted change in equity value; ALLA = total adjusted percentage change in firm value; ALL = total unadjusted percentage change in firm value. Values are averaged first within firm and then across firms.

change significantly (see t-statistics in the "percentage changes" columns).

The most interesting fact in Table 5 is that the average total risk-adjusted debt loss is less than 6.5 percent of the size of the average total risk-adjusted equity gain. Thus, it is clear that wealth transfers from debt holders cannot account for much of the gain to equityholders. In fact, two companies (Burlington and Leaseway) even experienced risk-adjusted bondholder wealth gains.[22]

3. Cross-Sectional Regressions

3.1 Bondholder losses and equity holder gains

We now investigate whether firms with significant bondholder losses are the same firms that experience significant equity holder gains. Panel A of Table 6 contains the results of regressions of normalized debt value changes (average risk-adjusted debt return multiplied by COMPUSTAT's reported debt, all divided by firm value) on normalized equity value changes (CRSP market-model-adjusted equity return multiplied by COMPUSTAT's reported market value of equity, all divided by firm value). According to the regression employing all bonds, there is statistical evidence of a relationship. However, a $1 gain in the overall value of a firm's equity is associated only with a $0.05 decrease in the overall value of its debt. Furthermore, in the statistically less objectionable regression that is run after averaging multiple bonds of the same firm into a single observation, there is less evidence of a statistically significant relationship between debt holder losses and equity holder gains.

The sum of the evidence leads us to conclude that equity gains are only a weak predictor of bondholder losses in LBOs. Those LBO firms where bondholders experience the highest losses are perhaps weakly related to the firms where shareholders gain the most. The wealth transfer hypothesis can account for only a small fraction of the wealth gain experienced by shareholders. It is worth noting that our data do not necessarily reject the hypothesis that equity holders expropriate wealth [e.g., as in Shleifer and Summers (1988)]. For example, equity holders may primarily expropriate employees or localities in which the firm is concentrated rather than bondholders.

3.2 Ex ante variable regressions

As described in the introduction, there are plausible hypotheses on what could cause bondholders' wealth losses. We now examine these

[22] Two of Burlington's bonds expired in 1990 (three years after the LBO) and one in 1995. Leaseway Transport's only outstanding bond expired just two years after the LBO, and two months after its downgrade, S&P upgraded this bond to a triple A. This was the only eventual upgrade we observed within a few months after the LBO.

Table 6
Cross-sectional regressions

A: Cross-sectional regression of normalized debt loss on normalized equity gain

	Intercept	Normalized equity gain	N	R^2	Adj R^2
All bonds	0.004043	−0.0698	42	0.2454	0.2265
	(0.52)	(−3.61)			
One bond/firm[4]	−0.004620	−0.0620	15	0.1511	0.0859
	(−0.36)	(−1.52)			

B: cross-sectional regression of risk-adjusted debt return[3] on ex ante variables

	Intercept	Rating	Time to maturity	Capital structure	N	R^2	Adj R^2
All bonds	−0.176289	0.03112	−0.00027	−0.2749	42	.6138	.5833
	(−4.38)	(6.62)	(−3.69)	(−2.48)			
One bond/firm	−0.157637	0.02569	−0.00015	−0.2611	15	.3136	.1264
	(−1.50)	(1.89)	(−0.74)	(−1.29)			

t-statistics are in parentheses below the coefficients. The 43 bonds employed here represent all bonds traded at Lehman Brothers over the period January 1985 through April 1989 that were issued by firms involved in a leveraged buyout and which had a consecutive time series of dealer quotes available around the month of the buyout announcement. Bond rating, time to maturity, and capital structure (book value of debt divided by firm value) are measured at the beginning of the event window. Firm value is approximated by the market value of equity plus book value of debt. Normalized debt loss is average risk-adjusted debt return (measured over the event window of one month before the LBO announcement to plus two months after the LBO announcement) multiplied by COMPUSTAT's reported book value of debt and divided by firm value. Normalized equity gain is CRSP's market-model-adjusted equity return multiplied by COMPUSTAT's reported market value of equity, all divided by firm value. Risk-adjusted debt returns were calculated by subtracting from the raw bond return the return of an index with rating and maturity characteristics similar to the bond of interest. The "adjustment" index was constructed from eight Lehman Brothers Corporate Bond indexes by linear interpolation of the two closest indexes in the dimensions of rating and maturity (again, bonds outside the available range of characteristics are benchmarked against the closest index). One bond/firm means that values are averaged first within firm.

losses in cross-sectional regressions on other firm-specific variables. We would expect several variables that are readily available before the LBO announcement to be related to the bondholder losses:

1. *Original bond rating.* We expect that a highly rated bond can lose more in an LBO, because the LBO either disproportionately increases the probability of bankruptcy and/or the bond's value losses in the event of bankruptcy. In other words, we predict that a firm that was already susceptible to bankruptcy before our LBO announcement date—perhaps because the rating agencies and the market had already impounded the LBO realization—would have had low bond ratings and bond prices to begin with. Our buyout announcement would probably not significantly have increased the bankruptcy probability/loss, and we would have observed a drop neither in bond rating nor in bond prices. In contrast, a firm that had high ratings would have been an unlikely candidate for bankruptcy and/or bond default without the (unexpected) LBO. The LBO could have drastically changed

this situation, and we would have observed a large loss both in bond ratings and bond prices.

Our hypothesis is consistent with the (unreported) finding that S&P downgraded all of our firms' bonds to below investment grade *regardless* of their original rating. In fact, the ex ante rating is almost a perfect proxy of the loss in rating around the LBO announcement.

Since we did not have enough observations to include individual dummy variables for each rating, we had to assign numerical values to individual bond ratings. These numerical equivalents are a naive translation of the bond ratings that reflect no prior beliefs as to whether the difference between AAA and AA bonds is less than or greater than the difference between (say) BBB and BB bonds.[23]

2. *Time to maturity.* Long-term increases in the variance of a firm's nonresidual payments to bondholders increase the risk of bankruptcy. This suggests that long-term debt holders lose more since they are more likely to face the consequences of increased leverage in a possible recession.

3. *Capital structure.* Weinstein (1983) developed a more formal model of bond beta in a framework consistent with the Black–Scholes–Merton option pricing model. He showed that beta is a function of the risk-free rate, the bond's time to maturity and coupon, and the firm's capital structure and the instantaneous standard deviation of return on the firm per unit of time. By linearizing the relationship between beta and the aforementioned variables, Weinstein is able to construct a model of bond return in a CAPM setting. Thus, all three variables discussed here are related to the risk of a bond and should have cross-sectional explanatory power.

Our interest is in determining whether risk-adjusted bond returns are related to ex ante firm characteristics. To do this we run a cross-sectional regression of bond returns over our four-month event window. Thus, in predicting risk-adjusted debt return, our independent variables are the time to maturity, pre-LBO rating, and pre-LBO capital structure (the total debt as a fraction of the total firm size). Because bond returns from the same company are highly correlated, we report the following results in two ways: (1) we use all individual bonds; (2) we first aggregate all bonds from the same company, and use the resulting 15 equally weighted portfolios. These methods provide two extreme bounds on the significance of reported regression parameter estimates. Under the assumption that companies' bond returns are perfectly correlated (uncorrelated), the aggregated (individual) regressions provide valid inference.

[23] The following scale was used: AAA = 2, AA+ = 3, AA = 4, AA− = 5, A+ = 6, A = 7, A− = 8, BBB+ = 9, BBB = 10, BBB− = 11, BB+ = 12, BB = 13, BB− = 14, B = 15, CCC = 16. The main consequence of improper scaling of bond ratings would be a loss of power.

The first line in panel B of Table 6 provides results for cross-sectional regressions of the entire set of individual risk-adjusted bond returns over the event window on the two ex ante variables motivated by the above discussion (the bond's time to maturity and rating) and a proxy for the ex ante capital structure of the firm (debt over firm size).

In the "one bond/firm" line in panel B, all relevant variables are (equally) averaged into one observation for each firm with multiple bonds. That is, the regression employs an equal-weighted bond portfolio return as the observation for a firm with more than one bond (as the dependent variable), with independent variables equal to average ratings and average time to maturity. The dispersions of the rating and capital structure variables are not affected. However, the time-to-maturity variable loses a significant amount of dispersion, because several firms have multiple bonds with very different times to maturity. Still, all observed coefficients indicate the same directional effect and are similar in size to the coefficient estimates in the "all bonds" regressions. Of course, with only 15 firms, the statistical significance of these coefficients is much lower. Still, the original rating remains significant.

4. Conclusion

We have documented that bondholders experienced significant wealth losses in successful LBOs of the 1985–1989 period. When measured exclusively by trader-quoted returns in the four-month period around the LBO announcement, the typical risk-adjusted (unadjusted) bondholder loss was about 6 (2) percent. We then examined the hypothesis that equity holder gains arose from the expropriation of debt holder wealth. We found (1) that losses in the value of debt were significant, but on average only 7 percent of the size of shareholder gains, and (2) that cross-sectional regressions indicated that those LBOs with the highest equity gains were only weakly related to the LBOs with the highest bondholder losses. Although our small sample size leaves open the question of whether our cross-sectional regressions were powerful enough to test the correlation between bondholder and equity holder returns, these two facts suggest that the primary impetus for LBOs in our period was not the exploitation of holders of public debt. We also predicted debt losses with pre-LBO information and found that higher-rated and longer-term bonds experienced on average greater wealth losses.

Finally, we compared sources of bond data and found significant differences between trader-quoted prices and both matrix-based and exchange-based prices. The most notable difference was a lagged response to the LBO announcement in matrix- and exchange-based data. We conclude that trader-quoted data is preferable in research investigating corporate bond reactions to firm-specific events.

Appendix: Return Calculations

This Appendix describes our return calculations in more detail. All debt return calculations are based on the full bond price, which is the quoted price of the bond plus accrued interest (30/360). Since our bond database provides only monthly prices, we had to construct monthly equity returns (and monthly Scholes–Williams market-model index portfolio returns, as described here) from the CRSP NYSEAMEX file. This was done with the formula

$$R = \left[\prod_{d=1}^{31} (1 + r_d) \right] - 1, \tag{A1}$$

where r_d and R denote the daily and monthly returns respectively, and d is a day index (for simplicity denoted to range from the first day of the month, 1, to the last day of the month, 31).

Next, we constructed risk- and maturity-adjusted return series for each month (often abbreviated to risk-adjusted return series). For each bond return, we subtracted the return of an equivalent benchmark index. The adjustment index was constructed from eight Lehman Brothers Corporate Bond indexes in the dimensions of risk and maturity.[24] Our eight Lehman Brothers Corporate Bond indexes contained all public, fixed rate, nonconvertible investment-grade domestic corporate debt. The indexes were divided into AAA, AA, A, and BBB bonds, and, within each ranking, into a long-term index and an intermediate-term index. The AAA Long-Term Index had an average maturity of 21–23 years and average duration of 8.5–10 years. The BBB Intermediate-Term Index had an average maturity of 6–6.4 years and an average duration of 4.25–4.5 years. Bonds outside the available range of characteristics were benchmarked against the closest index.[25]

For our equity series, we relied on CRSP's Scholes–Williams beta-adjusted returns, and created monthly equity returns. Finally, we computed cumulative abnormal returns. We did not use the standard abnormal performance index measure (API), for example, as in Cope-

[24] Although ad hoc linear interpolation rules for creating matrix prices can fail to capture firm-specific events, an ad hoc linear interpolation is not inappropriate for creating risk-adjusted bond indices. (The indices are not sensitive to the actual weightings.) It is only important that both indices capture general market movements. Figure 3 suggests that the risk adjustment procedure in this article is adequate because cumulative adjusted bond returns have insignificant fluctuations around zero in most months before the LBO announcement date.

[25] We also computed benchmarks that adjust only for maturity. However, because none of our results differ substantially from the risk- and maturity-adjusted portfolios, we report results using only the unadjusted and risk-adjusted bond returns.

land and Weston (1988), because our bond return series begin late for some bonds. The standard abnormal performance index would have first cumulated each bond's returns and then averaged cumulative returns across bonds. This can be misleading. For example, consider an event in which returns for two bonds are negative −1 percent for six consecutive months. However, although the first bond has return data for all months, the second bond has return data beginning only in month 4. Under the Copeland and Weston measure, the cumulative API is (as expected) −3 percent in month 3. However, in month 4, the cumulative API would be the average of −4 percent and −1 percent, that is, −2.5 percent. This would lead to the obviously incorrect conclusion that the marginal bond return in month 4 was positive (0.5 percent). Instead of the API, we compute (denoting the *i*th of *n* bond/firm returns in month *m* by $R_{i,m}$

$$\mathrm{CAR}(T) = \left[\prod_{m=(-12)}^{T} + \left(1 + \frac{\Sigma_i^n R_{i,m}}{n}\right)\right] - 1, \qquad \text{(A2)}$$

and CAR denotes cumulative return. The term R can stand for a single return in any of our four series: unadjusted debt returns, risk-and maturity-adjusted debt returns, unadjusted equity returns, or market-model-adjusted equity returns, and either represent a single bond or the average bond return for a single firm.

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