Financial Management

Lifting the Veil on Reverse Leveraged Buyouts: What Happens During the Private Period?

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We document the different types of restructuring activities undertaken during the private period after the reverse leveraged buyout (RLBO) of previously public firms. Preceding the LBO, firm leverage significantly exceeds that of their peers, while their profitability is better than the industry. However, despite their superior performance, these firms are undervalued before going private. While private firms undertake value-enhancement measures by increasing employee productivity, asset restructuring, decreasing cost of goods sold, and increasing ownership concentration. Enhanced valuation at the RLBO is a result of value capture, as well as efficiencies obtained from restructuring activities. We also identify factors determining the private period duration.

Over the past four decades, private firms going public through a reverse leveraged buyout (RLBO) transaction have increased in frequency and importance. RLBO transactions account for approximately 20% of all US initial public offerings (IPOs) and the proceeds from these re-IPOs are approximately twice the size of regular IPO deals (Cao and Lerner, 2009). While some prior studies examine changes around leveraged buyouts (LBOs) (DeAngelo, DeAngelo, and Rice, 1984; Lehn and Poulsen, 1989; Kaplan, 1991), others focus on financial and stock price performance after the RLBO (Cao and Lerner, 2009; Holthausen and Larcker, 1996). However, to date, there is very little evidence regarding restructuring activities during the private period of pure RLBO firms (i.e., firms going from public to private to public). This study offers some unique new insights on these leveraged deals by examining the financial performance and restructuring activities of previously public RLBO firms during the private period, specifically from the LBO to exit at the RLBO. The term RLBO is typically used to describe three distinct classes of transactions. Public-to-private transactions involve independent, publicly traded entities before the LBO (we refer to these as pure RLBOs), while division-to-private deals more closely resemble highly levered going private equity carve-outs. The third type is the private-to-private RLBO, where an unlisted company is typically acquired by a private equity group and subsequently taken public via an IPO. In this paper, we focus on public-to-private RLBO firms.

Our research design allows us to analyze efficiencies and productivity gains during the private period and their impact on valuation following the RLBO. Specifically, we examine changes in profitability, valuation, financial structure, operating structure, and cost structure from pre-buyout to post-exit. We address the following questions: What types of restructuring activities, in terms of changes in operating, financial, and cost structures, typically take place prior to a re-IPO? How do private period restructuring activities drive improvements in valuation? What are the ex ante

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determinants of private period duration? Our findings should allow us to observe the differences between public-to-private RLBOs and the commingled RLBO samples used previously in the literature.

Analysis of these issues is important for several reasons. First, our research design, which examines only public-to-private RLBOs, allows us to draw clean and reliable conclusions about firm restructuring activities from pre-LBO through post-RLBO. Our analytical framework enables us to infer the types of restructuring activities that take place during the private period as we are able to track the same firm across different parts of its journey.[1] Previous research that examined all the buyouts together did not allow for a comprehensive examination of the financial performance and restructuring activities of firms from pre-LBO to post-RLBO.

Additionally, by commingling different types of deals, previous studies ignore the fact that private-to-private and division-to-private transactions may reflect completely different attributes, motivations, and starting points when compared to public-to-private RLBO firms. There are several reasons for these differences. Bharath and Dittmar (2010) find that different economic forces motivate private and public firms. There are also structural differences in their firm characteristics. Private firms are characterized by smaller size, less leverage, lower dividend payouts, and greater ownership concentration (Villalonga and Amit, 2006). In addition, while public-to-private firms forgo the benefits of access to public markets, private-to-private firms may gain greater access to financing from private equity buyers. Firms that undergo public-to-private transactions also tend to be larger than their average industry peers relative to division-to-private or private-to-private ones, and are also less likely to suffer from adverse selection. Due to the size differential between these different types of RLBOs, their private period restructuring activities will also differ. For instance, larger enterprises are more likely to optimize the firm's asset mix by reversing previous diversification strategies. Thus, they are more likely to engage in asset sales of unproductive assets. The greater complexity of larger firms may also involve longer restructuring and entail a greater risk of failure. Moreover, given the pre-buyout size differential, it is more likely that privately held firms suffer from a lack of professional managerial skills than public firms. As such, these firms benefit more from enhanced managerial talent after the buyout. Finally, RLBOs going public for the first time are expected to experience greater informational asymmetries as compared to our sample of re-IPOs.

Therefore, it is not surprising that the prior literature, based on commingled RLBO samples, yields mixed and non-generalizable conclusions. For example, prior research finds mixed evidence regarding Jensen's (1986) free cash flow theory that active governance by buyout firms, combined with a higher concentration of ownership and discipline from high leverage, facilitates value creation.[2] It is possible that the heterogeneity of public-to-private and other buyouts is behind the mixed results. Specifically, Jensen's (1986) agency framework cannot explain private-to-private buyouts. Any agency problems in private firms are of a different nature than those at publicly held firms (Schulze et al., 2001; Howorth, Westhead, and Wright, 2004).

[1] In most prior studies, public-to-private LBOs represent a small fraction of the samples. The frequency of these firms is small on an absolute basis, as well. For example, in Muscarella and Vetsuypens' (1990) sample of 72 RLBOs from 1983 to 1987, only 18 transactions are originally public firms and data availability reduces that number to 14 or less. Smith's (1990) study that examines management buyouts includes 17 such deals, while Mian and Rosenfeld's (1990) sample includes 32 public-to-private firms. The same applies to Kaplan's (1991) and Cao and Lerner's (2009) samples.

[2] While a number of studies find evidence in support of enhanced efficiencies due to increased leverage and better alignment of incentives in buyouts (Lehn and Poulsen, 1989; Muscarella and Vetsuypens, 1990; Smith, 1990; Denis, 1992), others find no evidence to support the free cash flow argument in the United States (Maupin, Bidwell, and Ortegren, 1984; Servaes, 1994; Halpern, Kieschnick, and Rotenberg, 1999; Kieschnick, 1998) and in the United Kingdom (Weir, Laing, and Wright, 2005; Renneboog, Simons, and Wright, 2007). In addition, Nikoskelainen and Wright (2007) find that governance mechanisms resulting from a leveraged buyout are not the main drivers of value increases.

Similarly, although previous literature indicates that gains from LBOs may be driven by benefits from increased leverage, increased ownership concentration, and more robust interest tax shields (DeAngelo, DeAngelo, and Rice, 1984; Lehn and Poulsen, 1989; Kaplan, 1989b), the documented benefits from other restructuring activities are mixed. For example, Muscarella and Vetsuypens (1990) and Mian and Rosenfeld (1993) find significant gains in profitability, while Lowenstein (1985) determines that buyouts do not result in productivity gains and argues that tax savings are the main benefit from LBOs.

Prior research also yields mixed results surrounding the RLBO. Examining the year of the exit and the following year, Degeorge and Zeckhauser (1993) document superior performance in the year prior to the RLBO followed by disappointing performance after the re-IPO. This contrasts with Holthausen and Larcker's (1996) finding that RLBO firms outperform the industry when comparing the year prior to the IPO with four years after going public. Neither of these studies specifies the composition of their samples. Recently, Cao (2011) notes that post-RLBO underperformance is concentrated in firms remaining private less than a year. However, his results are not generalizable to public-to-private transactions as these constitute only a small fraction of his sample. Further, given that in the early 2000s there was a lull in public-to-private transactions (Kaplan and Stromberg, 2009), the composition of firms in more recent studies that focus on buyouts after 1990 tend to be tilted toward private-to-private firms.

A few prior studies of buyouts in highly concentrated industries also argue that productivity improvements depend upon how capital structure impacts product market competition. Kovenock and Phillips' (1997) findings suggest that for these industries, the disciplinary effect of leverage from an LBO is expected to lead to better profitability due to reduced industry competition and the elimination of unproductive assets. Examining four industries, Phillips (1995) finds that industry output is negatively related to industry average debt ratio in three of the industries. Similarly, Chevalier (1995) determines that leverage increases in the supermarket industry lead to less competitive pressure. Lichtenberg and Siegel (1990) find that a rise in productivity after the buyout is more pronounced for management buyouts (MBOs) (public and private MBOs) than for LBOs.

Our analysis contributes to the literature in several ways. First, using an exhaustive sample from 1978 to 2006, we demonstrate that in the five years leading up to the buyout, our RLBO firms carry a significantly higher leverage than their peers. Moreover, we find that RLBO firms are by no means underperforming firms as profitability measures are substantially higher than their industry rivals. Our analysis reveals that RLBO firms have undervalued equity at the time of the LBO and their valuation improves significantly after the private period. These findings are consistent with the "value capturing" notion. Our results imply that undervaluation of these firms before the buyout is a motivating factor for these transactions.

Additionally, our firms downsize significantly, improve their gross margins, implement more stringent cash policies, and enhance employee productivity through personnel reductions relative to control firms selected by propensity scores. These efficiency gains and a rise in the debt tax shield lead to greater firm profitability. Further, to address the potential concern that only the better firms in the pre-LBO period eventually emerge with a re-IPO, we compare our RLBO sample firms with non-RLBO firms (those that underwent a public-to-private buyout, but did not re-emerge through an IPO). This analysis reveals that the non-RLBO firms are no worse than the RLBO firms.

Moreover, we document that RLBO firms outperform their rivals for five consecutive years after exiting the private period. In addition, even though deleveraging occurs post-RLBO along with reductions in ownership concentration, both of these metrics remain above industry norms.

Finally, we examine the relationship between valuation and restructuring undertaken during the private period. Cross-sectional analysis suggests that private period restructuring improves efficiencies and reduces cost structure leading to higher valuation. Our results also indicate that these firms were undervalued at the time of the LBO. Overall, our findings contribute to the knowledge regarding how LBOs create value through various types of restructuring activities during the private period. Our analysis also suggests that pre-LBO undervaluation plays a key role in motivating these transactions.

The rest of the paper is organized as follows. The next section describes the sample selection process, methodology, and the data. We present our empirical findings in Section II. Section III provides our conclusions.

I. Sample Selection Process, Methodology, and Sample Description

A. Sample Selection Process

A common approach in the literature is to mix private-to-private and division-to-private RLBOs with public-to-private RLBOs. Our research design requires a sample comprised exclusively of public-to-private RLBOs in order to draw clean and reliable conclusions about firm activities from prebuyout through post-RLBO. We construct a comprehensive list of public-to-private RLBOs involving the hand collection of data from multiple sources as there is no one definitive database for such transactions.

We start with the Securities Data Company's (SDC) database to obtain RLBOs from 1978 to 1998. Mergers and Acquisitions data provide information on buyouts with a future IPO, while the New Issues table contains data on IPOs with a previous buyout. These two sources are then verified against each other. Since SDC stopped tracking re-IPOs after 1998, the sample is expanded with IPOs from 1999 to 2006 that are then matched against the existing list of buyouts. We supplement the SDC data with Cao and Lerner's (2009) sample.

Next, the Gale Business and Company Resource Center is used to validate candidate RLBOs by reviewing each firm's history and verifying that a company was publicly listed, privately held, and then public again. We also use this source to identify name changes taking place over the private period and verify that the SDC transaction dates are accurate. For example, SDC often defines a buyout as when the firm was first acquired by a private equity firms, even if the firm was previously taken private in a MBO. Additionally, we obtain pertinent information related to the firm from Gale.

We use firm names before the LBO and after the RLBO to search the Compustat Names table, as well as the Center for Research in Security Prices (CRSP) Stocknames file, enabling us to identify all required Committee on Uniform Identification Procedure (CUSIP) codes. We check the CRSP delisting code to verify whether it is a merger or an acquisition. Additionally, we require that firm data are available in both Compustat and CRSP. Our final sample spans the period from 1978 to 2006. To the best of our knowledge, our sample of 208 exclusively public-to-private RLBOs is the largest and most comprehensive sample of such transactions used in any study.[3]

[3] A recent study by Guo, Hotchkiss, and Song (2011) include public-to-private LBOs, but only a small number (28 firms) of their total sample of 94 deals with postbuyout data could be traced to an eventual IPO and an even smaller number of such firms are used in the pre- and postbuyout operating performance analysis (ranging from 13-22 firms). They provide evidence regarding buyout returns to stockholders from prebuyout to eventual outcomes (IPO, acquired while private, second buyout, file for Chapter 11, and remain private).

Further, our research design allows us to follow these firms from pre-LBO to post-RLBO thus offering some unique insight into these transactions.

B. Methodology

To test our hypotheses, we construct two control groups using two approaches. First, we industry-adjust our variables by three-digit SIC medians to distinguish RLBOs from their industry peers, especially at or before the LBO. Additionally, we select control firms based on propensity scores calculated at the LBO based on firm characteristics (Villalonga, 2004; Armstrong, Jagolinzer, and Larcker, 2010). The propensity score matching technique utilizes information from the pool of those firms with similar salient characteristics that choose not to go through a leveraged transaction. Propensity score matching is well established in observational studies including those examining the effects of medical treatment (Rosenbaum and Rubin, 1984; Imbens and Rubin, 2011). In our study, the restructuring that takes place while the firm is private is the "treatment" we are trying to measure. Propensity scores also provide protection against self-selection bias (LaLonde, 1986; Li and Prabhala, 2007).

We use a logistic model with data composed of our sample firms at the year of the LBO and control firms with available Compustat data for the same year. The dependent variable, *RLBO Dummy*, assumes a value of one for RLBOs and zero otherwise. The choice of explanatory variables in Equation (1) below is guided by the literature. Our specification also includes year and industry dummies based on the Fama and French (1997) 49 industry groupings. In an alternative specification, we employ Tobin's Q as alternative valuation measure in Equation (1) below. Our conclusions are unaffected when Tobin's Q is substituted.

$$\begin{aligned} \textit{RLBO Dummy} = \text{f}\,(&\textit{Assets}, \text{ROA}, \textit{P/Sales}, \textit{Div/TA}, \textit{R\&D/Sales}, \textit{Capex/Sales}, \\ &\textit{Turnover}, \textit{Year Dummies}, \textit{FF49 Dummies}). \end{aligned} \tag{1}$$

Next, we group our sample firms by propensity score quintiles. Control firms with a predicted RLBO probability below (above) the lowest (highest) quintile are dropped. We then assign the remaining control firms to the RLBO quintiles. Control firms are assigned without replacement based on the smallest absolute difference in propensity score with our sample firms. We verify the robustness of our assignment process using a difference in means and medians at the LBO. We find that with minor exceptions, our focus variables are insignificantly different from the controls in the same quintile. We also conduct our analysis using a smaller number of explanatory variables in Equation (1) and find the results to be robust to alternative specifications.

C. Sample Description

Table I, panel A, reports sample transactions by year for both LBO and RLBO transactions. There is a cluster of transactions for the years 1984-1989, corroborating previous research that in these years Drexel, Burnham, and Lambert financed a large volume of LBOs using junk bonds. The distribution of our sample mirrors that of all buyouts, peaking in volume in 1989.

In panel B, firms are grouped by private period duration, and approximately 60% go public again in less than five years. Panel C finds that the median (mean) time in the private period is 4.4 (5.4) years, which is longer than that reported in earlier studies. While most studies report around a 30-month private period length, the longer private period for our sample suggests that public-to-private transactions, which tend to be larger firms, take longer to restructure and go public again (see Cao and Lerner, 2009).

Table I. Descriptive Statistics of Reverse LBO Firms

This table presents the summary statistics of our sample firms. Panel A presents firms by year of the LBO and RLBO. Panel B reports RLBOs by years in the private period. Panel C summarizes the mean and quartiles of the private period duration. Years Private is the time period from the LBO to the RLBO. LBO refers to the year the firm was acquired in a LBO. The RLBO occurs when the firm is publicly traded again.

Panel A. RLBOs by Year

Year	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
LBO Count	2	6	3	7	1	5	11	10	22	17	34	22	9	3	5
RLBO Count	0	0	0	0	0	0	0	0	8	10	3	2	5	29	33

Panel A. RLBOs by Year (Continued)

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Total
LBO Count	4	3	0	4	8	6	4	4	4	4	6	4	0	0	208
RLBO Count	24	14	9	4	12	1	4	2	6	5	4	11	10	12	208

Panel B. RLBOs by Years Private

Years Private	0.0-0.9	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9
Firms	24	27	22	23	28	19	14	8	6	8	2
Pct. of Total	11.5%	13.0%	10.6%	11.1%	13.5%	9.1%	6.7%	3.8%	2.9%	3.8%	1.0%
Cum. Pct.	11.5%	24.5%	35.1%	46.2%	59.6%	68.8%	75.5%	79.3%	82.2%	86.1%	87.0%

Panel B. RLBOs by Years Private (Continued)

Years Private	11.0-11.9	12.0-12.9	13.0-13.9	14.0-14.9	15.0-15.9	16.0-16.9	17.0-17.9	19.0-19.9	20.0-23.9	Total
Firms	24	27	22	23	28	19	14	8	6	208
Pct. of Total	11.5%	13.0%	10.6%	11.1%	13.5%	9.1%	6.7%	3.8%	2.9%	100.0%
Cum. Pct.	11.5%	24.5%	35.1%	46.2%	59.6%	68.8%	75.5%	79.3%	82.2%	

Panel C. RLBO Private Period Statistics

Statistic	Mean	1st Quartile	Median	3rd Quartile
Years Private	5.46	2.01	4.38	6.91

Panel C. RLBO Private Period Statistics (Continued)

Propensity Quintiles	1	2	3	4	5
Years Private	4.89	4.82	4.88	4.49	3.92

We explore whether the longer private period is due to an unusually low frequency of "quick flips." The business media has coined the phrase quick flip to describe re-IPOs occurring within two years of going private. Our analysis indicates that 11.5% of buyouts reemerge publicly within one year and 24.5% reemerge within two years with a large proportion of the two-year flips (61%) occurring in 1986-1990. In comparison, Kaplan and Stromberg's (2009) study of all types of leveraged transactions finds that around 13% of transactions are flipped within two years. Hence, the longer private period for our sample firms cannot be attributed to a lower frequency of quick flips.

Similar to Mian and Rosenfeld (1993), Kaplan's (1991) study reports that RLBOs experience a high attrition rate where 40% of their samples are taken over within three years of the RLBO. In the same vein, Holthausen and Larcker (1996) find that almost half of their sample is acquired or goes private again in a re-LBO, while 8.9% default over four years post-RLBO. Of 208 firms that exit restructuring in our sample, 144 are still publicly traded five years later and 64 firms are delisted. Of the delisted firms, 53 (25% of the total sample) are due to mergers and acquisitions, which is substantially less than those observed by other studies. Additionally, about 5% of our firms experience financial distress, which is lower than that reported by Kaplan and Stromberg (2009). These findings, which contrast with other research that commingle different types of RLBOs, suggest that public-to-private transactions are composed of more robust firms.

We find that post-RLBO status is related to private period length. Firms delisted due to mergers or acquisitions have a median private period of 3.4 years compared to 4.7 years for those that remain publicly traded after five years. This difference is significant at the 5% level. One possible explanation for this finding is that firms that are delisted due to acquisitions remain undervalued in the post-RLBO period and, as such, become valuable and attractive targets. We also determine that the private period for firms that eventually succumb to financial distress, 5.5 years, is significantly longer than those firms that remain publicly traded.

II. Empirical Results

A. Univariate Analysis

1. Restructuring During the Private Period: From the LBO to the RLBO

Table II reports our univariate results from the examination of firm profitability, valuation, financial restructuring, operational restructuring, and cost structure from pre-LBO (LBO-0) through post-RLBO (RLBO+0). We compare firm fundamentals in the year of the LBO to those at the RLBO. To examine changes surrounding both the LBO and RLBO, we analyze available private period data. This approach reveals the types of restructurings that take place during the private period. Since going private transactions may lead to significant changes in a firm's assets, several variables are standardized by sales, namely, cash flow, capital expenditures, research and development expenses, cost of goods sold and selling, general, and administrative expenses. However, to maintain comparability between leverage, taxes, and interest expense, and to avoid confounding the results with changes in market conditions, we follow Cao (2011) and normalize these variables by the book value of assets.

Panel A of Table II reports findings using unadjusted (raw) financial variables, while panel B documents industry-adjusted variables based on the industry median value for each three-digit SIC code. The industry-adjusted financial information allows us to directly compare RLBOs to their peers before restructuring. In line with Barber and Lyon (1996), we test for differences in medians between our sample and industry peers at both the LBO and RLBO using the Wilcoxon

Table II. Financial Characteristics of RLBO Firms Surrounding the Private Period

This table reports the financial characteristics at the LBO and RLBO. The sample data include all public-to-private RLBOs from 1978 to 2006. Panel A summarizes the results for the raw variables with a paired median of differences test. Panel B reports the industry-adjusted variables (based on the three-digit SIC median). Panel C presents the differences in medians between the RLBOs and the control firms matched on propensity score quintiles. Panel D (which relates to panel C) provides the difference-in-differences estimator of the change over the private period. LBO-0 is the value immediately preceding the LBO. Values after the RLBO are designated by RLBO+0. RLBO-LBO is the difference before (after) the LBO (RLBO). The variables are defined in the Appendix.

	Panel A			*Panel B*			*Panel C*		*Panel D*
	Financial Characteristics			**Industry-Adjusted Financial Characteristics**			**Difference in Medians of Propensity Score Selected Firms**		**Diff.-in-Diff. Estimator**
Variable	**LBO−0**	**RLBO+0**	**RLBO− LBO**	**LBO−0**	**RLBO+0**	**RLBO− LBO**	**LBO−0**	**RLBO+0**	**RLBO− LBO**
Profitability & Valuation									
ROA	0.077	0.077	0.001	0.014***	0.018***	0.006	0.005	0.017***	0.035***
CF/Sales	0.059	0.059	0.001	0.015***	0.011***	0.000	0.007	0.003	−0.010
Tobin's Q	1.254	1.488	0.246***	0.026	0.085**	0.102**	0.053	0.212***	0.228***
P/Sales	0.448	0.671	0.087***	−0.017	−0.029	−0.035	−0.168***	0.032	0.191**
Financial Restructuring									
Leverage	0.227	0.418	0.150***	0.051***	0.192***	0.147***	0.000	0.190***	0.159***
Interest/TA	0.027	0.050	0.023***	−0.001	0.025***	0.026***	0.002	0.028***	0.024***
TaxRate	0.328	0.181	−0.133***	0.091***	−0.004	−0.078***	0.040***	−0.076***	−0.061
Cash/TA	0.048	0.031	−0.005*	−0.004	−0.019***	−0.013**	0.003	−0.020***	−0.021**
Div/TA	0.010	0.000	−0.003***	0.007***	0.000***	−0.003***	0.010***	0.000	−0.001
Shares/Owner (000)	3.020	47.666	37.622***	−0.477	35.255***	30.693***	−1.250*	41.378***	80.440***
Operating Restructuring									
Assets	463.895	493.278	20.850	317.705***	278.759***	11.584	372.131***	268.800***	−674.704***
Sales	678.859	522.376	6.723	406.213***	285.062***	−5.261*	581.177***	313.471***	−651.061***
Employees	6.462	3.590	−0.312***	4.205***	1.664***	−0.717***	5.099***	1.793***	−3.323***
Sales/Employee	97.042	131.686	33.583***	−0.767	11.955***	8.547***	−13.224**	−9.647	29.167**
PPE/TA	0.300	0.244	−0.042***	0.014***	−0.013	−0.032***	0.033*	−0.005	−0.036***
Capex/Sales	0.041	0.032	−0.008***	−0.001	−0.006	−0.006***	0.003	−0.004	−0.004
Cost Structure									
COGS/Sales	0.708	0.687	−0.019***	−0.005	−0.010**	−0.011**	0.020	−0.005	−0.022**
SG&A/Sales	0.182	0.179	−0.005	−0.031***	−0.040***	−0.003	−0.023**	−0.037***	−0.010
R&D/Sales	0.000	0.000	0.000	0.000	−0.000*	−0.000	0.000	0.000	−0.002
Observations		208			208			12,448	

***Significant at the 0.01 level.
**Significant at the 0.05 level.
*Significant at the 0.10 level.

signed rank test. Panel C tests for differences in medians at LBO−0 and RLBO+0 using the propensity score control firms. In panel D, we analyze whether there is a change in these variables during private period. To do so, we obtain the difference-in-differences estimator by regressing the change in a focus variable over the private period on *RLBO Dummy*, the predicted probability of an RLBO (*Propensity*), and the private period duration (*Private Period*). Our model is specified in Equation (2).

$$\Delta\text{Variable} = \text{f}(\textit{Propensity}, \textit{Private Period}, \textit{RLBO Dummy}). \quad (2)$$

Table III reports tests for changes surrounding the LBO and the RLBO for firms with available private period data. Specifically, panel A measures control-adjusted changes from LBO to one year later (LBO+1), while a similar analysis of changes from pre-RLBO (RLBO-1) to the RLBO

Table III. Financial Characteristics Surrounding the LBO and RLBO

This table reports the control-adjusted financial characteristics before and after the LBO and the RLBO. The sample data include all public-to-private RLBOs from 1978 to 2006. Panel A summarizes the results for the time surrounding the buyout, while panel B documents the variables surrounding the exit. Control firms are selected based on propensity score quintiles. LBO−0 is the median value immediately preceding the LBO. Firm fundamentals after the LBO are designated as LBO+1. Pre-RLBO variables are reported under RLBO−1. Values after the RLBO are designated by RLBO+0. Differences in the medians are reported at LBO−1, LBO+1, RLBO−1, and RLBO+0. A difference-in-differences estimator is calculated for LBO−0 to LBO+1 and RLBO−1 to RLBO+0. All variables are defined in the Appendix.

	Panel A. Before and After the LBO			*Panel B. Before and After the RLBO*		
Variable	**LBO−0**	**LBO+1**	**Diff.-in-Diff. Estimator LBO+1 − LBO−0**	**RLBO−1**	**RLBO+0**	**Diff.-in-Diff. Estimator RLBO+0 − RLBO−1**
Profitability						
ROA	0.007	−0.011	−0.009	0.014***	0.016***	0.005
CF/Sales	0.014	−0.011	−0.024***	−0.009	0.004*	0.017*
Financial Restructuring						
Leverage	0.072***	0.417***	0.196***	0.334***	0.182***	−0.128***
Interest/TA	0.004***	0.025***	0.019***	0.042***	0.027***	−0.014***
TaxRate	0.026	−0.151***	−0.097**	−0.119***	−0.068***	0.030
Cash/TA	−0.012	−0.026***	−0.026***	−0.028***	−0.020***	0.017**
Div/TA	0.008***	0.002	−0.004***	0.000	0.001	0.001
Shares/Owner (000)	−0.764	2.829	26.081***	35.578***	41.109***	−8.812
Operating Restructuring						
Assets	412.549***	560.533***	49.283	280.108***	321.579***	−36.542
Sales	670.614***	646.255***	−173.991***	336.909***	384.835***	16.307
Employees	5.358***	5.221***	−0.210	1.977***	1.984***	0.074
Sales/Employee	−7.429	−3.238	7.961	−6.293	−1.901	21.876***
PPE/TA	0.062**	0.011	−0.046***	0.017	0.002	−0.007
Capex/Sales	0.000	−0.004	−0.009	−0.001***	−0.005	0.003***
Cost Structure						
COGS/Sales	0.010	0.020	0.011	0.011	0.000	−0.007
SG&A/Sales	−0.010**	−0.013**	0.004	−0.026*	−0.042***	−0.012***
R&D/Sales	0.000*	0.000**	0.002	0.000	0.000	0.001
Observations		14,984			14,281	

***Significant at the 0.01 level.
**Significant at the 0.05 level.
*Significant at the 0.10 level.

year (RLBO+0) is included in panel B of Table III. We discuss these two tables jointly as the results are interrelated.

2. Changes in Profitability and Valuation

First, we investigate whether the pattern of firm profitability changes during the private period (Table II) and around the LBO and RLBO events separately (Table III). The analysis in panel B of Table II indicates that the industry-adjusted return on asset (ROA) is positive and highly significant

before the buyout. Thus, when compared to their peers, RLBOs are not underperforming at the LBO. The results in panels C and D suggest that restructuring leads to even greater asset returns, as *ROA* at RLBO+0 and the increase in *ROA* over the private period are highly significant as compared to the control firms. Our evidence using control-adjusted variables contrasts with findings of public LBOs in the United Kingdom (Weir, Wright, and Scholes, 2008) and in Denmark (Vinten, 2007). Their results document a decline in profitability following buyouts. Further, Guo, Hotchkiss, and Song (2011), who investigate public-to-private buyouts, find that for 28 firms (fewer firms with data), there is no change in the performance from the year prior to buyout to the year following the buyout.[4] Studies that examine smaller divisional buyouts and buyouts of private firms in Europe find that benchmark-adjusted profitability increases (Acharya, Hahn, and Kehoe, 2009), while studies investigating earlier US MBOs indicate significant gains in firm performance one year after the buyout (Kaplan, 1989a; Smith, 1990).

These results, along with the fact that our sample firms significantly outperform industry rivals in terms of ROA over the five years prior to going private, demonstrate that public firms that undergo these transactions are not necessarily underperforming firms. This analysis implies that undervaluation is an important factor for these leveraged going-private transactions.

As another performance metric, we use cash flow to sales (*CF/Sales*) to provide evidence as to how restructuring influences insiders' use of these funds. In panel B of Table II, we find that *CF/Sales* is significantly greater than their industry peers immediately preceding the LBO and after exiting the private period. Abundant cash flow prior to the LBO is consistent with the previous literature.

Figure 1 illustrates industry-adjusted *CF/Sales* from five years prebuyout to five years postexit. By examining firm characteristics over this 10-year period, we are able to track the efficacy of the private period restructurings, financial evolution, and firm performance for our sample. Generally, the figure indicates that the sample firms outperform their industry from five years prior to going private to five years after exiting the private period. Postexit five year performance is even better. Other control-adjusted financial performance metrics exhibit a similar pattern.

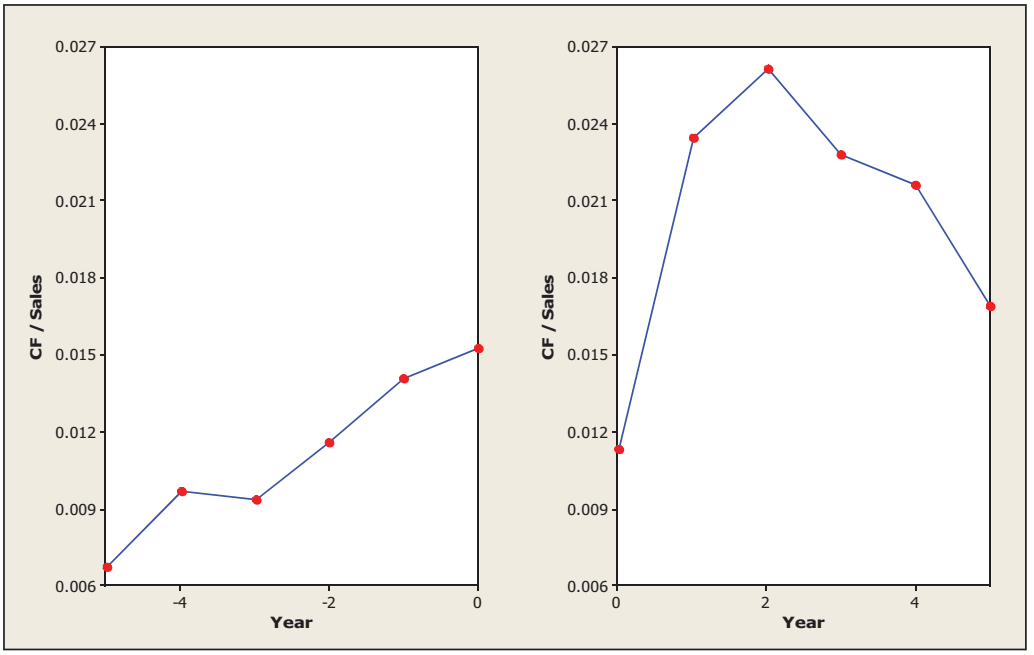
The results in panels B and C of Table II confirm that while pre-LBO Tobin's Q is at par with industry and control firms, this valuation metric is significantly higher than both control groups at the RLBO. This indicates that the sample firms experience a substantial improvement in firm valuation over the private period. Our results for strictly public-to-private transactions contrast with Opler and Titman's (1993) finding for a sample of commingled LBO deals. They determine that leveraged going private transactions are characterized by lower Tobin's Q.

Utilizing another valuation metric, *P/Sales,* our analysis reveals that both unadjusted and control-adjusted price-to-sales ratios increase substantially after the private period (see panels A and D of Table II). The fact that profitability measures are better than both the industry and the control firms before the buyout, while the valuation measures before the buyout are at par or worse than the controls, suggest that value capture is a key factor behind these going-private deals. Confirming this notion is the fact that upon reemerging as a public enterprise, firms are able to command higher equity valuation as evidenced by significantly higher Tobin's Q and the *P/Sales* multiple. Our finding is in contrast to the previous literature indicating that firms with excess cash flow, coupled with low investment opportunities, have a greater likelihood of going private via an LBO (Lehn and Poulsen, 1989; Opler and Titman, 1993). Our findings suggest that investors in LBOs of public firms are primarily motivated to capture value.

[4] However, their results are not directly comparable to our findings as they do not follow the firms from pre-LBO to post-RLBO.

Figure 1. Cash Flow

Figure 1 illustrates the cash flow to sales from five years before the buyout and the year of the LBO (graph on left) to the year of the IPO plus five years after the IPO (graph on right). *CF/Sales* is industry-adjusted by the three-digit SIC code median value.



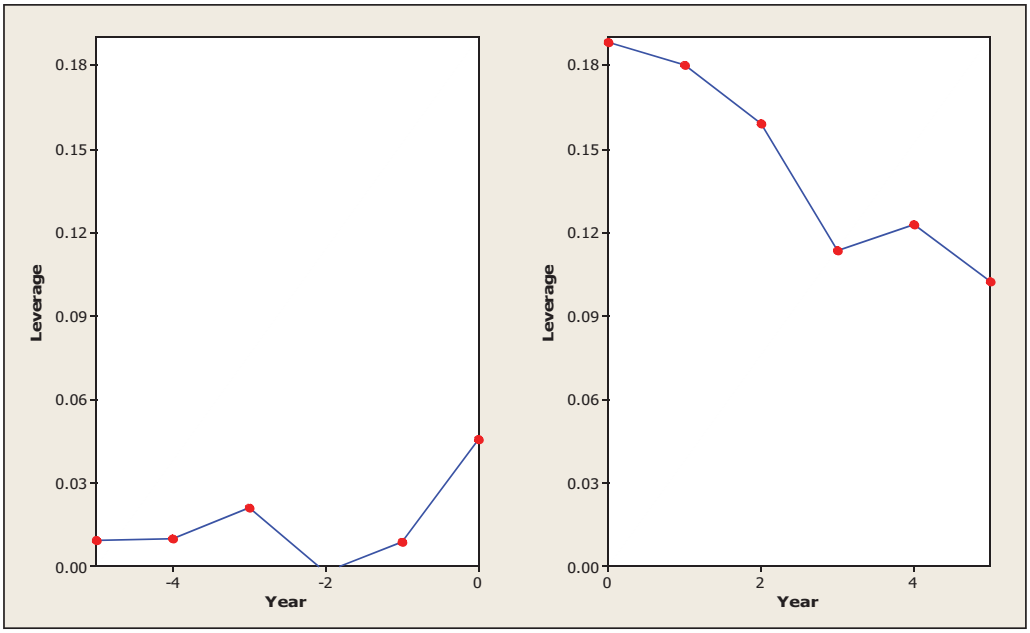
The fact that firms are taken private because they are undervalued is echoed in the financial press. A July 22, 2012 article in *The Wall Street Journal* by Anupreeta Das states, "Standard & Poor's has come up with a list of 10 publicly traded companies that could be LBO targets, based on current market trends . . . they picked companies trading at less than their respective industry's coming year-end price-to-earnings, which would indicate that the market currently undervalues them." Our results also highlight differences between United States and United Kingdom buyouts. We find US firms have greater cash flow and profitability measures, whereas Weir et al. (2008) submit evidence of no excess cash flow for a sample of UK buyouts from 1998 to 2000.

3. Financial Restructuring

As expected, we find substantive changes in the capital structure at the LBO. However, in contrast to prior research, our sample firms had greater leverage than the control firms and industry rivals prior to the LBO. This result may suggest that the LBO deal is not motivated by underutilization of debt prior to the buyout. The fact that the industry-adjusted leverage for these entities is higher following the going private transaction does not imply that these firms were underutilizing debt prior to the LBO, but rather reflects the very nature of these highly leveraged transactions. However, the disciplinary effects of leverage still seem to play a significant role in motivating these firms to make value-enhancing decisions, such as substantially reducing assets

Figure 2. Leverage

Figure 2 plots the long-term debt to assets (*Leverage*) from five years before the buyout and the year of the LBO (graph on left) to the year of the IPO and the following five years (graph on right). *Leverage* is industry-adjusted by the three-digit SIC code median value.



(as shown later) and improving profitability to prepare them for the RLBO. We find that it can take several years after the RLBO for these firms to move back toward a stable (or optimal) capital structure. In addition, an examination of leverage over five years preceding the LBO confirms this conclusion with leverage greater than the industry and controls each year. This is graphically illustrated in Figure 2, depicting the time trend in industry-adjusted *Leverage* over a 10-year period surrounding the going private and exit transactions.

Additionally, there is a large and highly significant drop in indebtedness post-RLBO, suggesting that a portion of the proceeds from the offering is used to reduce debt, as is typical in such highly leveraged transactions. Further, the trend after the re-IPO indicates that firms are still in the process of shifting toward more manageable, stable, and optimal debt levels over the following five years.

As expected, in Table III, panel A, changes in *Interest/TA* mirror those of *Leverage* with *Interest/TA* increasing substantially surrounding the LBO. This trend is reversed at the RLBO with a significant decline in interest due to the reduction in long-term debt (Table III, panel B).

The effective tax rate (*TaxRate*) of almost 33% pre-LBO declines by almost half (to around 18%) as firms emerge from the private period restructuring, likely due to elevated debt tax shields. The decrease is significant at the 1% level and supported by adjusted results in panels C and D that are qualitatively similar. Further, at the LBO, industry-adjusted *TaxRate* is positive and

significant at the 1% level. In Table III, panel A, we report that control-adjusted *TaxRate* declines significantly one year into the private period. Overall, our results support Kaplan's (1989b) findings that RLBOs create value through tax benefits.

To examine liquid asset management of these firms during the private period, we employ cash to total assets, *Cash/TA*. We find that while pre-LBO *Cash/TA* is at par with industry and control firms, it declines significantly during the private period, on both a raw and an adjusted basis. Table III demonstrates that the reduction in *Cash/TA* occurs immediately after the LBO, but is partially reversed after the exit. The change in *Cash/TA* reflects a more stringent cash management policy during the private period, which is largely maintained when the firm reemerges publicly.

The results reported in Table III suggest that dividends (*Div/TA*) decline right after the buyout, while there is no change surrounding the RLBO. Since the observed decline in dividends to total assets in the year after the LBO may be due to asset write-ups, we compare dividend payouts and find no change from prebuyout to postbuyout payouts. It is also noteworthy that the *Div/TA* of LBO firms is substantially higher than the industry and controls at the LBO (see Table II, panels B and C). The commitment of the sample firms to pay higher dividends and service higher debt levels, combined with greater profitability prior to the buyout, suggests that cash flow related agency costs are exaggerated for public-to-private going private transactions.

As anticipated, ownership concentration (*Shares/Owner*) at the LBO increases substantially during the private period (Table II, panels A, B, and C). The industry-adjusted *Shares/Owner* is insignificant pre-LBO, indicating that our leveraged going private transactions did not differ from industry norms in terms of this governance aspect. While the control-adjusted ownership concentration increases during the private period, this variable declines after the RLBO, but remains above the corresponding industry norm during the five years after the re-IPO.

4. Operations Restructuring and Changes in Cost Structure

In this section, we examine the operational and cost structure changes during the private period. Examining operations variables, panel D in Table II reports substantial downsizing with the real book value of assets (*Assets*) standardized to the year 2000 declining significantly during the private period. While no changes occur surrounding the LBO and RLBO (Table III), firms initiate substantive changes in asset composition over the private period (Table II, panel D). Based on our difference-in-differences estimates (Table II, panel D), we find that there is a significant downsizing of assets during the private period. This is accompanied by a substantial reduction in sales relative to controls. The decline begins immediately after the LBO, as demonstrated in Table III, panel A.

Another indication that our firms engage in restructuring to improve efficiency and productivity is the significant decline in personnel count (*Employees*) on both an absolute basis and relative to industry peers and controls, as illustrated in Table II. The analysis in Table III indicates that these actions do not typically occur near the LBO, as the difference in *Employees* pre- and post-LBO is insignificant. Further, we note that operational restructuring (in terms of assets and employees) leads to efficiency gains in employee productivity on both an absolute basis, as well as relative to the control sample as evidenced by a significant increase in sales per employee (*Sales/Employee*). This significant improvement in *Sales/Employee* continues after the RLBO as illustrated in Figure 3, which presents industry-adjusted *Sales/Employee* from pre-LBO to post-RLBO.

Since asset write-up at the buyout can obfuscate asset restructuring, we investigate the restructuring of tangible assets as captured by property, plant, and equipment (*PPE/TA*). *PPE/TA* declines significantly during the private period on an absolute basis and relative to control firms.

Figure 3. Sales per Employee

Figure 3 reports the sales per employee from five years before the buyout and the year of the LBO (graph on left) to the year of the IPO plus five years after exit (graph on right). *Sales/Employee* is industry-adjusted by the three-digit SIC code.

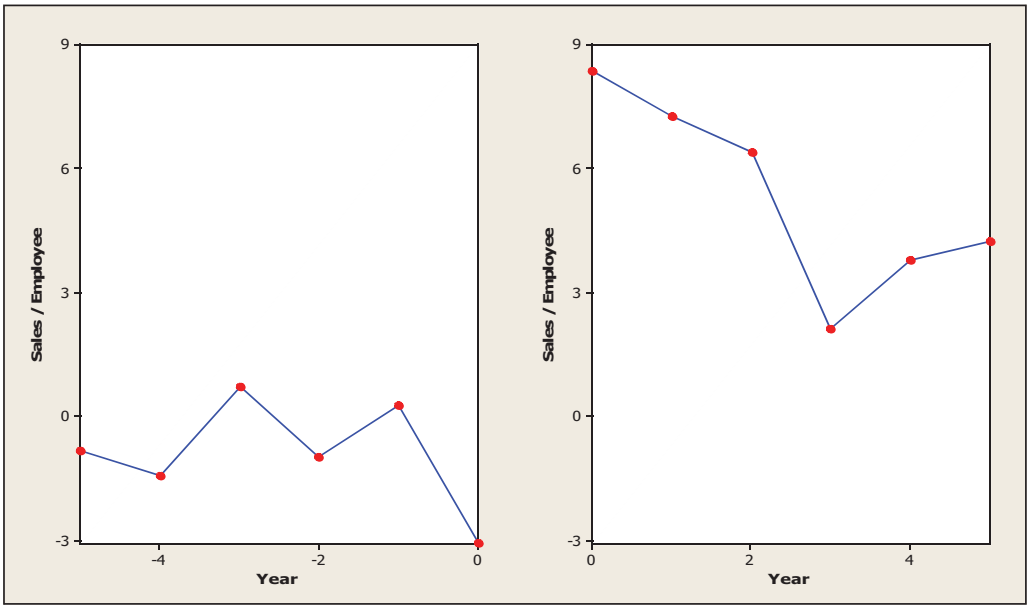


Table III demonstrates a substantial downsizing in *PPE/TA* within the first year of going private and this process is completed in the pre-RLBO year (i.e., no significant change in RLBO-1).

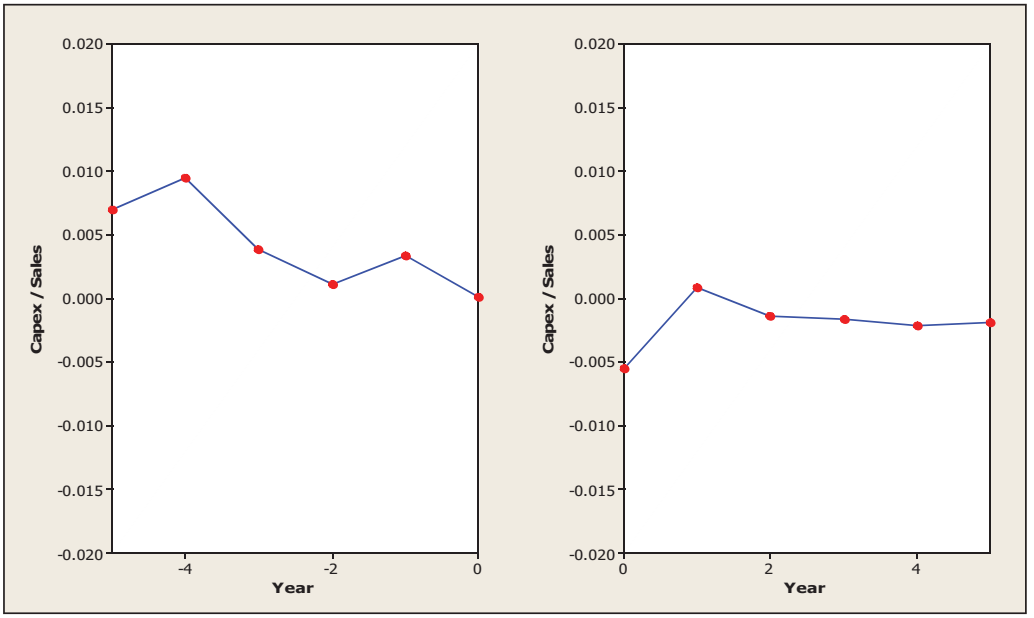
There is no overinvestment in the year preceding the LBO in terms of capital expenditures to sales (*Capex/Sales*). Specifically, the industry-adjusted *Capex/Sales* is insignificant pre-LBO, providing additional evidence that agency issues are not a primary motivation for going private. Restructuring leads to closer monitoring of investment policy, as pre-RLBO control-adjusted *Capex/Sales* is significantly negative (see Table III, panel B). While *Capex/Sales* increases from the pre-RLBO to post-RLBO year, the level is comparable to control firms. In comparison, Holthausen and Larcker (1996) report insignificant industry-adjusted capital expenditures following the RLBO. The trend for this variable is depicted in Figure 4.

When examining the cost structure, we find that cost of goods sold to sales (*COGS/Sales*) decreases markedly from LBO to RLBO on an absolute basis, as well as relative to industry and control firms (see Table II). The statistically significant decrease in *COGS/Sales* implies a corresponding increase in gross margin. We also determine that the change around the buyout is insignificant, suggesting that longer private periods are required to effect margin improvements.

Panels B and C of Table II report that our sample firms are characterized by lower selling, general, and administrative expenses to sales (*SG&A/Sales*) than the industry and control firms at both the LBO and RLBO. This may be due to economies of scale given that our sample firms tend to be larger than the industry norm. Although the changes in *SG&A/Sales* during the private period are insignificant (since they are already lower than the industry and control firms when

Figure 4. Capital Expenditures

Figure 4 plots the capital expenditures to sales (*Capex/Sales*) from five years before the buyout and the year of the LBO (graph on left) to the year of the IPO plus five years after exit (graph on right). *Capex/Sales* is industry-adjusted by the three-digit SIC code.



entering the private period), Table III (panel B) indicates a significant decrease surrounding the RLBO.

Research and development (R&D) expenditures (*R&D/Sales*) are another potential target for restructuring during the private period. Industry-adjusted *R&D/Sales* at the LBO is similar to that of their industry counterparts. Whether examining changes from pre-LBO to post-RLBO (Table II) or around the LBO and RLBO events (Table III), we find no changes in R&D investment decisions whether the firms are compared to their industry peers or to the control group. This finding, combined with the fact that this metric is significantly higher than the control firms in the year following the LBO (Table III), suggests that managers take a long-term view and do not reduce expenditures that may influence the firm's future opportunities. This result stands in contrast to the prior literature.

In summary, we find that during the private period, our sample firms significantly downsize total assets, fixed assets (*PPE/TA*), and employees resulting in improved productivity. This finding of a substantial reduction in *PPE/TA* is consistent with the disciplining effect of leverage. One plausible explanation for this result lies in the previous literature that finds dramatic increases in leverage leads to less competition and, as such, higher margins and greater profitability (Chevalier, 1995; Kovenock and Phillips, 1997).

The investment decisions for our sample firms, reflected in capital and R&D expenditures, remain similar to the control firms over the various stages from pre-LBO to post-RLBO. Thus,

the downsizing conducted during the private period may reflect overinvestment in previous years (specifically years -5, -4, and -3 as per Figure 4). Further, our sample firms enjoy lower *SG&A/Sales* relative to the matched control firms prior to the LBO and after exit, while managing to reduce *COGS/Sales* significantly over the private period. These restructuring measures undertaken during the private period lead to superior firm performance and higher valuation upon exit.

5. Robustness Checks: Univariate Analysis

Our results in Tables II and II use control firms selected by propensity score quintiles without replacement. To ensure that our results are robust to the selection methodology, we replicate both tables by selecting control firms with replacement and obtain similar conclusions. Variables retain the same sign and significance. As another robustness check, we restrict controls to the 10 firms with propensity scores closest in absolute difference to our sample firms. All of our conclusions remain robust to this approach.

We further validate our findings using the difference-in-differences estimator to measure private period changes by testing for differences in group medians using the Wilcoxon signed rank test. All of our conclusions hold when employing this alternative methodology. Finally, five of our sample firms have a private period less than 60 days. To preclude the possibility that our results are driven by these deals, we repeat the analysis excluding these firms and obtain qualitatively similar results with coefficients consistently having the same sign and magnitude as before.

6. Comparative Analysis of RLBO and Non-RLBO Firms

To address the potential concern that only the "better" firms in the pre-LBO period eventually emerge with a re-IPO, we conduct additional analysis. Based on pre-LBO data, we compare our RLBO sample firms with those firms that underwent a public-to-private LBO, but did not reemerge as a public entity (we call this the non-RLBO group). We are able to collect data for 570 non-RLBO firms. We report the comparative analysis of the two samples in Table IV.

Our analysis reveals that the non-RLBO firms have very similar industry-adjusted salient financial characteristics, such as profitability (*ROA* and *CF/Sales*), leverage, investments (*Capex/Sales*, *R&D/Sales*), cost structure (*COGS/Sales*), asset structure (*PPE/TA*), sales per employee, and ownership concentration (*Shares/Owner*). Similar to our RLBO sample firms, these non-RLBO firms significantly outperformed their industry rivals in terms of *ROA* and *CF/Sales*, while carrying higher leverage and larger dividend payouts than the industry norms. Hence, our RLBO firms are no better than the non-RLBO firms. Similar to the RLBO sample, the non-RLBO firms are also larger than the industry average in terms of firm size, sales, and employees. Both valuation measures indicate that non-RLBO firms are significantly undervalued when compared to their industry norms. However, when compared to our RLBO firms, the non-RLBO firms are significantly smaller in terms of assets, sales, and number of employees. They are also more undervalued than our sample firms.

B. Multivariate Analysis

1. Private Period Restructuring and Valuation at the RLBO

In the previous section, we identify the value drivers that emerge as a result of restructuring during the private period, such as operating efficiencies, lower cost structure, increased leverage, and downsizing. While restructuring activity may enhance value, the univariate analysis suggests that RLBO firms are undervalued at the LBO when compared to the control firms. In this section, we investigate whether the improvement in valuation is strictly due to restructuring changes or

Table IV. Comparison of Firm Characteristics Categorized by Non-RLBO and RLBO Firms

This table reports the median industry-adjusted financial characteristics before the LBO for public firms that went private subdivided into those that eventually go public through an IPO (RLBOs) and those that do not (Non-RLBOs). The sample data include all public-to-private RLBOs from 1978 to 2006 with nonmissing financial data. Values are at the LBO−0 (immediately preceding the buyout). All variables are defined in the Appendix.

Industry-Adjusted Firm Characteristics	Non-RLBOs	RLBOs	RLBOs − Non-RLBOs
Profitability			
ROA	0.005**	0.014***	0.009
CF/Sales	0.009***	0.015***	0.006*
Tobin's Q	−0.139***	0.026	0.165***
P/Sales	−0.131***	−0.017	0.114***
Financial Restructuring			
Leverage	0.000***	0.051***	0.051
Interest/TA	0.000***	−0.001	−0.001
TaxRate	0.043***	0.091***	0.049*
Cash/TA	0.000***	−0.004	−0.004
Div/TA	0.000***	0.007***	0.007***
Shares/Owner (000)	0.000***	−0.477	−0.477
Operating Restructuring			
Assets	22.689***	317.71***	295.02***
Sales	22.823***	406.21***	383.39***
Employees	0.104***	4.205***	4.101***
Sales/Employee	0.648***	−0.767	−1.415
PPE/TA	0.006**	0.014***	0.009
Capex/Sales	−0.002	−0.001	0.001
Cost Structure			
COGS/Sales	−0.001**	−0.005	−0.004
SG&A/Sales	−0.007*	−0.031***	−0.024***
R&D/Sales	0.000	0.000	0.000
Observations	507	208	778

***Significant at the 0.01 level.
**Significant at the 0.05 level.
*Significant at the 0.10 level.

whether the accrued benefits to our sample of firms are partly due to undervaluation at the LBO. To do so, we use multivariate analysis to examine the drivers of the improved valuation and incorporate *RLBO Dummy* in our valuation models. This variable examines whether the change in RLBO sample firms' valuation exceeds that of control firms, after controlling for restructuring activity undertaken during the private interval. A positive and significant coefficient on this variable implies that a portion of improved valuation is due to value capture (i.e., undervaluation at the time of the buyout). We employ two valuation metrics used by investment bankers to value firms (DeAngelo, 1990): 1) the price-to-sales ratio (*P/Sales*) is our relative equity valuation metric and 2) Tobin's Q is used to proxy for firm valuation.

Our model employs the difference-in-differences estimator, where the data include both RLBOs and control firms. This approach enables us to control for all of the factors used to select

control firms through the *Propensity* variable, which provide additional protection against sample selection bias. We also ensure that our regressions are not impacted by multicollinearity by verifying that the variance inflation factor is within acceptable limits. Several robustness checks are performed to validate our key findings.

For the RLBO firms, changes are measured during the private period, while for the control firms, variables are calculated for a matching time period. Our control variables include *Propensity*, Δ*Assets*, and Δ*Market Share*. In addition, we include the following industry control variables: *HerfindahlLBO*, Δ*Industry ROA,* Δ*Industry P/Sales,* and Δ*Industry Tobin's Q*. Several different specifications of the general model in Equation (3) below are reported in Table V. Standard errors are computed using White's (1980) correction for heteroskedasticity. All of the variables are defined in Appendix A.

$$\begin{aligned}\Delta\text{Valuation} = \text{f}(&\Delta Assets, \Delta Leverage, \Delta\text{ROA}, Propensity, \Delta Industry\ ROA, \Delta Industry \\ &P/Sales, \Delta Industry\ Tobin's Q, \Delta Market\ Share, HerfindahlLBO, \\ &RLBODummy, \Delta COGS/Sales, \Delta SG\&A/Sales, \Delta Capex/Sales, \\ &\Delta R\&D/Sales, \Delta Employee).\end{aligned} \tag{3}$$

In Table V, we report regression estimates that explain Δ*P/Sales* and Δ*Tobin's Q*. We employ the change in industry P/Sales when explaining Δ*P/Sales* in models 1-4, while the change in industry Tobin's Q is utilized in Δ*Tobin's Q* specifications in models 5-8. In these regressions, we focus on key variables capturing the change in profitability (Δ*ROA*), cost structure (Δ*COGS/Sales* and Δ*SG&A/Sales*), investments (Δ*R&D/Sales* and Δ*Capex/Sales*), and financial structure (Δ*Leverage*).

As expected, the evidence in models 1 and 3 indicates that increases in equity and firm valuations are inversely related to cost structure (Δ*COGS/Sales* and Δ*SG&A/Sales*). Moreover, in all of the models that include Δ*ROA*, we find that valuation is positively related to a change in firm performance. The coefficients on these variables imply that capital markets value restructuring that improves the gross margin.

Models 2, 3, and 6 confirm that firm investment policy is value enhancing with positive and significant coefficient estimates on Δ*R&D/Sales* and Δ*Capex/Sales*. Thus, these results imply that capital investment policies are implemented with a long-term perspective in mind and that the market values such restructuring decisions taken during the private period. While Singh (1990) reports reductions in capital requirements after buyouts, by using propensity-score matched firms, we find that an increase in capital investment is a driver of equity value. The restructuring of the firm through the reduction of employees is also found to significantly enhance firm value in model 7.

More importantly, our focus variable, *RLBO Dummy*, is consistently positive and significant in all six models. This provides evidence that the change in equity and enterprise value for sample firms during the private period exceeds that for control firms. Since we control for restructuring activities and industry factors, this offers compelling evidence that our sample firms were undervalued at the time of the LBO and that the investors in the buyouts were able to capture value. The average coefficient on *RLBO Dummy* in models 1-3 of 0.227 implies that the median firm with *P/Sales* of 0.448 (Table II, panel A) experiences roughly a 50% increase in equity valuation as a result of going private after controlling for restructuring activity. A comparable analysis regarding the impact of the LBO on a firm's *Tobin's Q* from models 5-7 suggests an improvement of around 10% in enterprise value. The magnitude of these coefficients is not only statistically significant, but also economically relevant.

To put this in perspective, the impact of significant improvement in RLBO firms' *ROA* (compared to control firms) over the private period of 0.035 (Table II, panel D) based on the Δ*ROA*

Table V. Regressions Explaining the Change in Valuation

This table summarizes the results of the ordinary least squares (OLS) regressions, where the dependent variable is Δ*P*/*Sales* in models 1-4 and Tobin's Q in models 5-8. Independent variables include firm fundamentals over the same time period. The sample consists of exited buyouts from 1986 to 2006 and control firms are selected on propensity score quintiles over matching time periods. *p*-values are reported in parentheses. All variables are defined in the Appendix. Standard errors are calculated with White's (1980) correction for heteroskedasticity.

Dependent Variable	**Δ*P*/Sales**				**ΔTobin's Q**			
Independent Variables	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**
Intercept	−0.071***	−0.028***	−0.082***	−0.124***	0.005	0.017*	−0.013	−0.021
	(0.00)	(0.01)	(0.00)	(0.00)	(0.66)	(0.06)	(0.16)	(0.14)
Propensity Score	10.011***	10.880***	10.543***	17.671***	8.935***	7.896***	9.091***	12.593***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
HerfindahlLBO				0.257***				0.095***
				(0.00)				(0.01)
Δ*Market Share*				−0.000***				−0.000***
				(0.00)				(0.00)
Δ*Industry ROA*	0.080	0.005	0.106		0.087	0.011	0.016	
	(0.56)	(0.97)	(0.44)		(0.50)	(0.93)	(0.32)	
Δ*Industry P/Sales*	0.023***	0.026***	0.024***	0.042***				
	(0.00)	(0.00)	(0.00)	(0.00)				
Δ*Industry Tobin's Q*					0.120***	0.121***	0.117***	0.114***
					(0.00)	(0.00)	(0.00)	(0.00)
Δ*Assets*	0.026	0.006	0.031*	0.033**	−0.186***	−0.169***		−0.152***
	(0.12)	(0.71)	(0.06)	(0.03)	(0.00)	(0.00)		(0.00)
Δ*Leverage*	−0.875***	−0.888***	−0.873***	−0.915***	−0.222***	−0.151***	−0.233***	−0.188***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
Δ*ROA*	0.497***	0.820***	0.902***	0.852***		0.697***	0.604***	0.709***
	(0.00)	(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)
Δ*COGS/Sales*	−1.529***				−1.280***			
	(0.00)				(0.00)			
Δ*SG&A/Sales*					−1.241***			
					(0.00)			
Δ*Capex/Sales*		1.798***		1.882***		0.192***		0.327***
		(0.00)		(0.00)		(0.00)		(0.00)
Δ*R&D/Sales*			4.116***					
			(0.00)					
Δ*Employees*							−0.005***	
							(0.00)	
RLBO Dummy	0.202**	0.259**	0.220**	0.274***	0.124*	0.115*	0.099***	0.136*
	(0.05)	(0.02)	(0.04)	(0.00)	(0.08)	(0.07)	(0.09)	(0.07)
Δ*Leverage* ∗	0.631**	0.471	0.685**	0.375	0.823***	0.763***	0.902***	0.715***
RLBO Dummy	(0.03)	(0.12)	(0.02)	(0.19)	(0.00)	(0.00)	(0.00)	(0.00)
Adjusted R^2	8.01	12.30	5.52	12.85	6.29	6.79	2.86	5.33
Observations	12,438	12,438	12,438	11,985	10,544	12,428	11,953	11,973

***Significant at the 0.01 level.
**Significant at the 0.05 level.
*Significant at the 0.10 level.

coefficient in model 1 implies an increase in equity valuation (*P/Sales*) of 1.7% (0.035∗0.497), while a significant reduction in the cost of goods sold of 0.022 relative to control firms (Table II, panel D) implies a 3.4% rise in value. Thus, while the combination of cost efficiencies and improvement in firm performance may lead to a 5.1% bump in stock value as compared to a control

firm, the mere fact that our firms went private enhances their value even further. This evidence strongly suggests that one of the motivations for public-to-private buyouts is the undervaluation of the firm's equity prior to going private.

We also find that the unconditional financial structure term, Δ*Leverage*, is negatively related to Δ*P/Sales* and Δ*Tobin's Q*. However, when we interact Δ*Leverage* with *RLBO Dummy*, we obtain a positive and highly significant coefficient. In the equity valuation models (Δ*P/Sales*), the magnitude of the positive coefficients for the interaction term, Δ*Leverage*∗*RLBO Dummy*, are roughly similar in magnitude to the estimated negative coefficient for the unconditional term, Δ*Leverage* (i.e., the sum of the two coefficients are not statistically different from zero). In the models explaining Δ*Tobin's Q*, the positive coefficients for the cross-product term Δ*Leverage*∗*RLBO Dummy* are significantly larger than the negative coefficients on the unconditional Δ*Leverage* term. These results indicate that leverage is value enhancing to RLBO firms, but not to control firms. This may also imply that the capital structure due to the LBO translates into better monitoring effects for the firm.[5]

Kovenock and Phillips (1997) and Phillips (1995) argue that increased postbuyout leverage in highly concentrated industries commits the firm to reducing assets and output leading to lower industry competition. Therefore, in our multivariate analysis, we also control for industry concentration and market share. In two specifications, models 4 and 8, we include the degree of industry concentration as measured by the asset Herfindahl Index at the LBO (*HerfindahlLBO*) and the change in market share (Δ*Market Share*). The coefficients on both these control variables are consistent with the findings in this literature. More importantly, all of our results continue to hold, as all of the other variables maintain the same sign and level of significance.

In all of the equity valuation models, we include Δ*Industry P/Sales* and find this variable to be a significant determinant of equity valuation. The coefficient on this variable, which is included in the first four models, is positive and statistically significant. Similarly, the coefficients on the Δ*Industry Tobin's Q* in the last four models are also significantly positive.

2. Robustness Checks: Multivariate Results

The results above employ propensity-score matched control firms by quintile obtained without replacement. We test the robustness of our findings by replicating our regression models, but limiting the control firms to those with the 10 propensity scores closest in absolute difference to our sample of RLBOs. All of our findings are robust to this alternative methodology. We also reproduce Table V using a set of control firms selected by quintile with replacement and obtain qualitatively similar results. Finally, analysis employing Heckman's (1978) self-selection model further alleviates concerns of sample selection.

In sum, our study indicates that there are two major benefits from these going private transactions. First, there are measurable benefits from the restructuring activities undertaken during the private period resulting in improved valuation. Moreover, even after controlling for reorganization and industry-wide changes, we find that the change in valuation for RLBO firms is larger than that of the controls. Thus, our firms, which are undervalued prior to buyout, also benefit through

[5] In unreported regressions, we find that growth in sales has a value enhancing effect on the firm. We also employ an interaction term between sales growth and *RLBO Dummy* and find that valuation is higher for RLBO firms, suggesting that restructuring activity employed by RLBO firms during the private period to increase sales is value enhancing.

value capture that helps the market accurately value these firms after they reemerge as public entities.

C. Ex Ante Determinants of Private Period Duration

While prior research investigates the relationship between post-RLBO variables and the length of the private period (Cao, 2011), the literature has yet to explore the role of ex ante factors in determining private period duration. Typically, LBO funds have a limited life cycle of 10-12 years, which places liquidity demands on them prompting them to exit their investments as the fund approaches maturity. Complementing Cao's (2011) study, we examine the private period duration based on ex ante factors that drive the restructuring process. Our research design that focuses on previously public RLBO firms allows us to present evidence that may be useful in predicting private period duration at the time of the LBO. This predictive knowledge may be valuable to both private equity investors and market participants as LBO longevity has been noted to be an important determinant of firm performance after going public. In Table VI, we report Tobit regressions using *Private Period* as the dependent variable.

We include as control variables: *Assets* measuring the book value of the firm's assets, *Tobin's Q* and *P/Sales* to proxy for firm growth opportunities, *MBO* which is a dummy variable if the firm went private in a MBO, a variable proxying for a hot LBO market, *LBO Market*, and a yield curve proxy, *TermPremium*. Other pertinent ex ante explanatory variables include *Leverage*, *Cash/TA*, *ROA*, *COGS/Sales*, *SG&A/Sales*, and *Capex/Sales*. We also control for the impact of the Tax Reform Act of 1986 (*TRA86*) by creating a dummy that we interact with the tax variables, *TaxRate_Pre1987* and *TaxRate_Post1986*, and cash flow variables, *CF/Sales_Pre1987* and *CF/Sales_Post1986*. All regressions are estimated using industry-adjusted (based on the three-digit SIC code) financial variables measured at the time of the LBO, and are defined in the Appendix. Several specifications of the general model below are estimated.

$$\begin{aligned} RLBOYears = \mathrm{f}(&Assets, Leverage, Cash/TA, ROA, COGS/Sales, SG\&A/Sales, Tobin's Q, \\ &P/Sales, Capex/Sales, MBO, LBO\ Market, TermPremium, TaxRate\_Pre1987, \\ &Tax\,Rate\_Post1986, CF/Sales\_Pre1987, CF/Sales\_Post1986), \end{aligned} \tag{4}$$

where $f(.) > 0$.

First, we examine whether firm leverage at the time of the LBO determines the length of the private period. A higher than industry leverage level may lead to a shorter private period as excessive debt may result in less financial flexibility, thus making the firm more vulnerable to competition. In support of the financial flexibility argument, we find that higher firm liquidity, exhibited by higher *Cash/TA*, leads to a longer private period (see model 2). We document a negative and significant link between *Leverage* and the private period in all four models. This finding is again consistent with the disciplinary effect of leverage forcing the firms to make value-enhancing changes quickly during the private period to improve profitability and reemerge as public entities through an IPO. For a sample of commingled RLBOs, Cao (2011) finds that leverage at the re-IPO is unrelated to the duration of the private period.

We include *COGS/Sales* in model 1 to test the conjecture that firms with a more efficient cost structure will be able to emerge from restructuring faster. The positive and significant coefficient on this variable confirms the relevance of cost structure to the length of the private period. We also incorporate the *SG&A/Sales* variable in model 1. This variable has the expected positive sign, but is not statistically significant. This may be because selling, general, & administrative expense (SG&A) costs represent a smaller fraction than cost of goods sold and also due to the

Table VI. Regressions Explaining the Duration of the Private Period

This table reports the results from regressions explaining private period duration with prebuyout factors. The sample consists of RLBOs from 1986 to 2006. The regressions employ a Tobit specification with *Private Period* as the dependent variable. All variables are measured at LBO-0 (immediately before the LBO), except for *Capex/Sales* that is measured one year prior to the buyout. All variables are industry-adjusted by three-digit SIC code medians. See the Appendix for variable definitions. *p*-Values are reported in parenthesis.

Explanatory Variables	Model 1	Model 2	Model 3	Model 4
Intercept	10.05***	9.45***	7.60***	12.05***
	(0.00)	(0.00)	(0.00)	(0.00)
Assets	−0.16	1.04**	−0.18	−0.07
	(0.75)	(0.04)	(0.69)	(0.87)
Leverage	−11.43***	−13.68***	−16.10***	−12.44***
	(0.01)	(0.00)	(0.00)	(0.00)
Tobin's Q	−0.39			
	(0.77)			
P/Sales				−0.78**
				(0.04)
COGS/Sales	16.70**			
	(0.04)			
SG&A/Sales	8.40			
	(0.23)			
ROA		−30.79***		
		(0.01)		
Cash/TA		15.03**		
		(0.05)		
Capex/Sales			−11.36**	
			(0.05)	
TaxRate_Pre-1987			5.62**	
			(0.04)	
TaxRate_Post-1987			−2.40	
			(0.41)	
CF/Sales_Pre-1987				−17.49
				(0.56)
CF/Sales_Post-1987				−15.60**
				(0.04)
MBO	−5.64**	−1.81	−0.06	
	(0.05)	(0.51)	(0.98)	
LBO Market	−0.29***	−0.32***		−0.29***
	(0.00)	(0.00)		(0.00)
TermPremium		−2.16***	−2.21***	−1.80***
		(0.00)	(0.00)	(0.00)
Observations	120	153	132	140
Chi-Squared Tax Rate			3.41*	

***Significant at the 0.01 level.
**Significant at the 0.05 level.
*Significant at the 0.10 level.

fact that our sample firms already have low SG&A costs when compared to their peers (observed earlier). We also posit that firms with superior profitability at the LBO will be able to emerge as public entities sooner. Our results in model 2 are consistent with this prediction where ROA is negative and significant at the 1% level.

In model 3, we find a significant negative link between pre-LBO *Capex/Sales* and the duration of the restructuring period. This evidence supports the notion that higher pre-LBO capital expenditures reflect necessary firm investments in assets, which is the key to maintaining current and future growth. Thus, these firms are better prepared to reemerge publicly as compared to those firms that have been neglecting capital investments prior to the LBO.

Kaplan (1989b) confirms that tax effects play an important role in LBOs, and the evidence presented thus far suggests that the pre-LBO marginal rates of the sample firms are higher than their peers. However, the Tax Reform Act was an external event that lowered rates for all firms thereby reducing tax benefits obtained from LBOs. As a result, it also reduces one of the primary advantages of buyouts (Newbould, Chatfield, and Anderson, 1992). Therefore, we expect that above industry tax rates prior to *TRA86* should lead to a longer private period. We test this in model 3 and, as predicted, the coefficient on *TaxRate_Pre1987* is positive and significant, while *TaxRate_Post1986* is not statistically different from zero. Further, the Chi-squared statistic rejects the null that the two coefficients are equal.

Bharath and Dittmar (2010) find that free cash flow is a determinant of LBO probability in the 1980s, but not in subsequent years. Since *CF/Sales* is calculated on an after-tax basis, an alternative interpretation is that Bharath and Dittmar (2010) are actually detecting the impact of *TRA86*. We investigate this possibility through two variables, *CF/Sales_Pre1987* and *CF/Sales_Post1986,* to account for the potentially different relationship in the private period duration between the two tax regimes. Model 4, which includes both of these variables, indicates that the coefficient on *CF/Sales_Post1986* is negative and significant, while the coefficient of *CF/Sales_Pre1987* is not statistically different from zero. The fact that these results are a mirror image of those found for taxes suggests that post-*TRA86* free cash flow leads to a shorter private period than the same level pre-1987.

Cao (2011) examines whether ex-post macroeconomic variables influence the length of the private period. However, no previous study has investigated whether ex-ante economic conditions are relevant to the length of the private period. We test for the impact of hot buyout markets (defined as the number of LBO deals in a month) and the term structure of interest rates by including these two variables, *LBO Market*, and *TermPremium*, in some regression models. We obtain negative and highly significant coefficients for *TermPremium* implying that a steep yield curve tends to reduce the private period. It also suggests that LBOs occurring during periods characterized by high interest rates have less financial slack and, as such, restructure faster and exit sooner. The coefficient on *LBO Market* is negative and highly significant suggesting that "quick flips" are more likely during periods of high buyout activity. The *MBO* dummy is generally insignificant indicating that management involvement does not impact the length of restructuring.

As a robustness check, we employ unadjusted firm fundamentals with industry fixed effects. The results confirm our findings for the ex-ante determinants of private period duration. A potential concern with the *Tobit* approach is the requirement for normally distributed data. Hence, for robustness, we follow Cao (2011) and use ordinary least squares regression with the natural logarithm of one plus *RLBOYears* as the dependent variable. The results using this approach are very similar with all of the coefficients maintaining the same sign as before. Our finding that free cash flow and taxes have a differing impact on private period duration after *TRA86* remains similar to those obtained using *Tobit*. The explanatory power of long-term debt and the macroeconomic variables are qualitatively the same as when using *Tobit*.

III. Conclusions

Using an exhaustive sample of pure RLBOs from 1978 to 2006, we examine the restructuring activities undertaken during the private period and the resulting changes in valuation of these firms. Contrasting our results with previous research, we demonstrate that these firms are more profitable than their peers prior to going private. Further, our sample firms hold significantly more debt than their industry competitors in the prebuyout period. The fact that firm capital investments do not translate into lower profitability, combined with the commitment to service higher debt levels and higher dividends in the prebuyout period, does not support the conventional notion that these firms are poorly run. However, these firms still seem to benefit from the disciplinary effects of increased leverage. In spite of their superior performance, our sample firms command lower valuations at the buyout, which appears to be one of the primary motivations behind the buyout transactions. The study contributes to our knowledge as to how LBOs create value by undertaking various types of restructurings during the private period and how these measures determine the value of these firms at exit and beyond.

Our sample firms enhance productivity through a reduction in the labor force and achieve greater efficiencies by decreasing the cost of goods sold. Firm profitability relative to control firms improves significantly at the point of re-IPO relative to the prebuyout period. One notable finding is that sample firms' valuations increase substantially relative to those firms with the same predicted probability of an RLBO irrespective of the measure used.

After exiting the private period, firm performance remains at levels better than their industry peers for five consecutive years. Further, even though post-IPO deleveraging occurs along with reductions in ownership concentration, both these metrics continue to remain at elevated levels and far exceed industry norms. The private period restructuring also leads to a more stringent liquidity policy. Employee productivity gains are documented only for the year of the exit and the following year. Thus, private period restructuring of these previously public entities yield significant efficiency gains. A comparative analysis of RLBO and non-RLBO buyout firms, based on pre-LBO data, indicates that RLBO firms are no better than LBO firms that did not emerge in an IPO.

Multivariate regressions of the factors determining valuation improvement confirm findings from univariate analysis, suggesting that restructuring activity manifests in superior firm values at the re-IPO. Our study indicates that there are two major benefits from these going private transactions. First, there are measurable benefits from the restructuring activities undertaken during the private period resulting in improved valuation. Additionally, these firms, which are typically undervalued prior to the LBO, benefit through value capture as the valuation improves at the re-IPO.

We examine the ex ante determinants of private period duration and find that buyouts during periods of high LBO activity and a steep term structure of interest rates lead to a shorter private period. High profitability, lower costs, higher leverage, and higher capital expenditures also lead to a shorter private period. Our findings indicate that the disciplinary effect of leverage forces firms to make rapid value-enhancing changes to improve profitability during the private period and reemerge as public entities. In contrast, high liquidity provides private equity investors with greater flexibility to restructure over a longer period. Finally, our study also suggests that tax effects play a role in the private period duration.

Appendix

Definitions of Firm Characteristics Variables

Assets	Book value of total assets (Item #6) in real 2000 dollars
Sales	Net sales (Item #12) in real 2000 dollars
Capex/Sales	Capital expenditures (Item #128) divided by sales (Item #12)
Cash/TA	Cash (Item #1) divided by total assets (Item #6)
COGS/Sales	Cost of goods sold (Item #41) divided by sales (Item #12)
CF/Sales	Earnings before interest, taxes, and depreciation (Item #13) less interest expense (Item #15), taxes (Item #16) less dividends (Items #9 + #21) over sales Item #12)
Div/TA	Dividends (Items #19 + #21) divided by total assets (Item #6)
Employees	The number of employees (Item #29)
FF49 Dummies	Industry dummies based on Fama and French (1997) 49 industry groupings
Growth	Percent change in sales (Item #12) over the private period
HerfindahlLBO	Industry Herfindahl index at the LBO based on total assets (Item #6)
Interest/TA	Interest expense (Item #15) divided by total assets (Item #6)
Leverage	Long-term debt (Items #9 + #44) divided by total assets (Item #6)
Market Share	Firm's percentage of industry Net Sales (Item #12)
P/Sales	Market value of equity (Items #199 ∗ #25) divided by sales (Item #12)
PPE/TA	Net property, plant, and equipment (Item #8) divided by total assets (Item #6)
ROA	Earnings before interest (Items #172 + #15) divided by total assets (Item #6)
R&D/Sales	Research and development expenses (Item #46) divided by sales (Item #12)
Sales/Employee	Sales (Item #12) divided by employees (Item #29)
SG&A/Sales	Selling, general, and administrative expense (Item #189) divided by sales (Item #12)
Shares/Owner	Equity shares (Item #25) over common shareholders (Item #100) in thousands
TaxRate	Income taxes (Item #16) over earnings after interest and depreciation (Item #178)
Tobin's Q	Total Assets (Item #6) less common equity (Item #60) plus market value of equity (Items #199 ∗ #25) divided by total assets (Item #6)
Turnover	Common shares traded (Item #28) divided by equity shares (Item #25)

RLBO Transaction Variable Definitions

LBO Market	The number of LBOs in a given month
MBO	Equal to one if the LBO was through a MBO, zero otherwise
Private Period	The years from the LBO to the RLBO
Propensity	The predicted probability of an RLBO at the time of the LBO
Quick Flip	Equal to one if the private period is less than one year, zero otherwise
RLBO Dummy	Equal to one for RLBO firms and zero for control firms
TermPremium	The difference between the ten-year T-bond rate and three-month T-bill interest rate

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