Distortion in corporate valuation: implications of capital structure changes

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Abstract

Purpose – The traditional discounted cash flows (DCF) valuation procedure used by financial analysts assumes that firms maintain a policy of fixed debt. However, empirical evidence suggests that many firms rebalance their debt. This paper seeks to explore the implication of this discrepancy for valuation of firms that undergo a capital structure change.

Design/methodology/approach – The approach taken is both theoretical and empirical.

Findings – The authors show how the valuation process should be modified for firms that are expected to rebalance their debt and demonstrate the distortion in value that results if the traditional DCF valuation procedure is used instead. Furthermore, they illustrate the significance of their results using a sample of the largest largest leveraged buyouts of the current decade.

Originality/value – To the authors' knowledge, this is the first investigation into this issue.

Keywords Valuations, Finance, Capital structure

Paper type Research paper

I. Introduction

Since the turn of the century, the investment community has witnessed dramatic growth in capital structure changing transactions. This growth has been stimulated by a number of factors including private equity firms and their willingness to structure major leveraged buyouts and firms announcing sizable share repurchase programs[1]. The investment community has been left to assess the impact of such capital structure changes on company value. In particular, this challenge has caused us to revisit one of the more frequently used valuation methodologies, discounted cash flows (DCF).

In the standard application of DCF, the expected free cash flows net of corporate taxes are discounted at the weighted average cost of capital (WACC), a rate that accounts for the tax shield from interest payments. Without a capital structure change, finding this discount rate from the financial markets is straightforward. Yet, such a change requires adjusting the discount rate. To make this adjustment, analysts generally use a set of relationships developed by Hamada (1972) almost 40 years ago (Damodaran 2002; Bruner, 2004; Ross *et al.*, 2005). The process involves "unlevering" and then "relevering" the beta, taking into account both the firm's old and new capital structure.

An important assumption underlying this traditional adjustment for a capital structure change is that following the change the firm will maintain its debt level fixed, henceforth, a policy of fixed debt. However, many equity analysts using the traditional capital structure adjustment have it wrong. Increasing evidence, suggests that the fixed debt level assumption is not appropriate for many firms. Namely, many firms instead have a policy of rebalancing their debt level with fluctuations in their enterprise value so as to maintain their debt ratio fixed, henceforth, a policy of rebalanced debt. In other words, evidence suggests that following a capital structure change, rather than keep their debt level fixed, many firms keep the ratio of debt-to-equity fixed. In fact, researchers have not yet determined whether the policy of rebalancing or maintaining a fixed debt level is the predominant corporate debt policy. The incorrect choice of methodology in valuing a firm can lead to severe mispricing.

In this paper, we demonstrate that the valuation of firms that are about to undergo a capital structure change depends on the assumption of whether debt is fixed or rebalanced. We show that the valuation depends crucially on whether the firm has a policy of fixed or rebalanced debt. Given the contradicting empirical evidence considered above, we suggest that when performing a valuation, it is important that one first makes an assumption about the firm's debt rebalancing policy to be adopted following the capital structure change. If the assumption is fixed debt, the traditional (standard) valuation method is appropriate. However, in the common case, in which a firm is expected to rebalance its debt in order to maintain a fixed debt ratio, an alternative procedure should be used. This paper provides guidance in assessing the effect of such debt policy differences on company valuation.

To understand the effect of these alternative debt policies, we demonstrate our argument on a sample of the largest leveraged buyouts (LBOs) of the current decade. For example, in two recent transactions, Univision and Freescale Semiconductors, we show that the value differences between the policies of fixed debt and rebalanced debt as a percentage of the deal value are, respectively, 11.8 and 14.7 per cent. Moreover, the differences as a percentage of the pre-transaction equity value are, respectively, 14.7 and 22.6 per cent. The magnitude of such differences is often under appreciated by valuation practitioners.

A dramatic increase in the number and dollar volume of LBOs between 2004 and 2007 highlights the economic significance of new tax shields associated with levered transactions. The dollar volume of LBOs in the USA exceeded $390 billion in 2006. This was more than four times larger than the volume of LBOs in 1988 which was the peak year of the prior wave (in the 1980s, Mehran and Peristiani (2010), Figure 1)[2]. It is important for both analysts and financial managers to correctly evaluate the benefits of any new debt financing. Analysts have the responsibility for providing an assessment of the deal valuation to the shareholders. Financial managers of acquiring firms should be able to correctly evaluate the post-deal value in order to appropriately structure the deal; financial managers of the target firm should be able to correctly evaluate the deal in order to decide whether to accept or reject the offer. Using the Hamada equation to evaluate firms which have a policy of rebalancing their debt can result in significant overestimation of the firm's value. We show that such an overestimation can be costly.

The tendency of practitioners to assume that debt would likely be fixed in the future probably emanates from historical reasons. Modigliani and Miller (1963) developed their theorems under the assumption that firms keep their debt fixed following a capital

structure change. Most of the earlier literature followed by making a similar assumption (Hamada 1972). The later theoretical literature however recognizes that it is more likely that firms would keep their debt ratio rather than debt level fixed. Ruback (2002) assumes that firms rebalance their debt and Brealey *et al.* (2008) suggest that most researchers today take it as given that firms rebalance their debt. Most textbooks however, are inconsistent in providing valuation formulas in that some are based on fixed debt and others are based on rebalanced debt. This inconsistency leads to significant confusion[3]. Our main contribution is in reviewing and comparing levering and unlevering for the fixed and rebalanced debt assumptions. We also demonstrate that the choice between these alternative approaches has significant consequences for practical valuations of firms that undergo a change in capital structure.

The issue of whether firms rebalance their debt has stimulated an abundance of empirical investigations; interestingly, the evidence to date is inconclusive. Welch (2004) suggests that debt ratios fluctuate mainly because the market value of the firm fluctuates. He concludes that firms do not rebalance their debt. Baker and Wurgler (2002) find that firms do not have target debt ratios but rather issue securities to take advantage of favorable market conditions. Fama and French (2002) find that firms rebalance in the long run but not in the short run, whereas Leary and Roberts (2005) find that the tendency to rebalance is negatively correlated with transactions (issue) costs. Chang and Dasgupta (2009) demonstrate that even if firms randomly choose their financing, the data may appear as if they have a policy of rebalanced debt, although in fact they do not. Alti (2006) demonstrates that firms doing an IPO tend to rebalance their debt ratio back to the pre-IPO ratio within two years. Most leveraged buyout firms declare their intention to "grow out of their debt," clearly indicating that their policy is not to rebalance. Overall, it appears that some firms rebalance their debt while others do not.

Adjustments for non-fixed debt have been considered earlier in the academic literature. Miles and Ezzell (1985) is a foundation paper in this area. They are the first to suggest that when the firm maintains a constant debt ratio rather than a constant debt level, "the marginal value of debt financing is much lower than the corporate tax rate." They also derive an unlevering procedure for the case of a constant debt ratio. Taggart (1991) expands the analysis to compare the DCF valuation under a fixed debt level policy and fixed debt ratio policy for the WACC and adjusted present value (APV) methods. Arzac (1996) develops a recursive model in which he simulates valuation errors under rebalancing assumptions that deviate from the firm's policy. Ruback (2002) develops the capital cash flow (CCF) method under the assumption of a fixed debt ratio and compares the valuation implications to that of the APV method under fixed debt.

Like much of the literature on DCF valuation, our analysis adopts a framework in which the only market imperfection is corporate taxes. That is, we abstract from all market imperfections other than corporate taxes such as personal taxes, bankruptcy costs, information asymmetry, agency costs, and transaction costs. In an environment where only corporate taxes are considered, the implied tax shield is in the range of 30-40 per cent per dollar of debt. However, some authors incorporate personal taxes as well and suggest that the resulting benefit is substantially reduced (Taggart, 1991; Emery *et al.*, 2007). Bankruptcy costs also reduce the benefit from debt financing. Financial managers often think of the firm's debt-equity decision as a trade-off between corporate tax shield and the costs of financial distress (the "trade-off theory", Adsera and Vinolas, 2003; Cohen and Yagil, 2007; Brealey *et al.*, 2008; Damodaran, 2011).

Hull (2007) develops an elegant capital structure model (CSM) which incorporates corporate taxes, personal taxes, and financial distress costs in evaluating the benefit of debt financing. His CSM model suggests that the advantage of debt financing is in the range of 7-15 per cent, on average. Indeed, empirical studies suggest that the net benefit of debt financing may be low. Graham (2000) estimates that the corporate and personal tax benefit of debt can be as low as 4.3 per cent of firm value. Korteweg (2010) argues that the net benefit of leverage is typically 5.5 per cent of the firm value. Graham and Harvey (2001) survey managers and find that firms are also concerned about financial flexibility and credit rating when determining their financial leverage.

The following organization describes the structure of the paper. Section II reviews the DCF valuation procedure when capital structure is changed, namely the procedure to unlever and relever the WACC. Section III demonstrates the implications of different debt policies on valuation using numerical examples. Section IV demonstrates the difference in valuation between a policy of fixed debt and rebalanced debt using a sample of recent large leverage increasing transactions. Section V concludes.

II. DCF valuation: review of unlevering and relevering

This section reviews the DCF valuation procedure for firms that undergo a change in their capital structure under a policy of fixed debt and under a policy of rebalanced debt. The procedure is commonly known as the free cash flow method. In this method, the expected free cash flows net of corporate taxes are discounted at the WACC, a rate that adjusts the cost of debt for the tax shield from interest payments. This rate is:

$$WACC \equiv r_W = \frac{D}{V_L} r_D(1 - \tau) + \frac{E_L}{V_L} r_{E_L} \tag{1}$$

where D and E_L are the market values of debt and (levered) equity, respectively. $V_L = D + E_L$ is the market value of the firm, τ is the corporate tax rate, and r_D and r_{E_L} are the cost of debt and levered equity, respectively. The inputs for the WACC are generally obtained from market data.

A capital structure change, namely, a leverage increasing/decreasing transaction requires adjusting the WACC because the debt ratio changes and because the cost of equity r_{E_L} also changes with leverage.

A. The policy of fixed debt

The standard valuation procedure assumes a firm maintains its debt level fixed, and adjusts the WACC as follows: The analyst unlevers the beta of the equity β_E using the Hamada (1972) equation:

$$\beta_U = \frac{\beta_{E_L}}{1 + (1 - \tau)D/E_L} \tag{2}$$

where β_U is the unlevered beta (beta of the assets) and D/E_L is the current debt-to-equity ratio. She then uses the same equation with the projected new debt-to-equity ratio to find the new (relevered) beta of the equity β_{E_L} where:

$$\beta_{E_L} = \beta_U \left[1 + (1 - \tau)\frac{D}{E_L}\right].$$

The CAPM is then used to find the cost of equity under the new capital structure:

$$r_{E_L} = r_f + \beta_{E_L}(\bar{r}_m - r_f),$$

where r_f and $(\bar{r}_m - r_f)$ are the risk-free rate and the market premium, respectively. This new cost of equity r_{E_L} and the projected new D/V_L and E_L/V_L ratios following the capital structure change are then substituted into equation (1) to determine the adjusted WACC[4].

While the Hamada relationship equation (2) is commonly used in the finance literature, it assumes $\beta_D = 0$. The more general between β_{E_L} and β_U assumes $\beta_D \neq 0$, and can be obtained as described below (Oded and Michel, 2007a).

We begin by noting that the standard accounting identity $V = E + D$ also holds for market values. We can also write:

$$V_L = V_U + TS = E_L + D \tag{3}$$

where V_U is the value of the (assets of the) unlevered firm, and TS is the value of the tax shield[5]. In the case where the level of debt is assumed to be maintained fixed following the leverage change, it is reasonable to assume that the risk of the tax shield is the risk of the debt, i.e. $\beta_{TS} = \beta_D$. This is because the firm gets a tax shield whenever it pays the interest[6]. Accordingly, under the assumption of fixed debt, $r_{TS} = r_D$. In this case, under the simplifying and common assumption of perpetuity, the value of the tax shield in the accounting identity equation (3) is:

$$TS = \frac{\tau D r_D}{r_{TS}} = \frac{\tau D r_D}{r_D} = \tau D$$

We can thus write equation (3) as:

$$V_L = V_U + \tau D = E_L + D \tag{4}$$

The beta of a portfolio is always the weighted average of the beta of its components. Hence, we can write:

$$\frac{V_U}{V_L}\beta_U + \frac{\tau D}{V_L}\beta_D = \frac{E_L}{V_L}\beta_{E_L} + \frac{D}{V_L}\beta_D$$

Upon substituting $V_U = V_L - \tau D$ and rearranging, we can express β_{E_L} as:

$$\beta_{E_L} = \beta_U + (1 - \tau)\frac{D}{E_L}(\beta_U - \beta_D). \tag{5}$$

Using equation (5) and the CAPM, we can thus describe how r_{E_L} changes with leverage:

$$r_{E_L} = r_U + (1 - \tau)\frac{D}{E_L}(r_U - r_D). \tag{6}$$

This rate is then substituted into equation (1) to obtain the adjusted WACC.

If one substitutes $\beta_D = 0$ into equation (5), the Hamada equation (2) is obtained. This equation is the one generally used to adjust β_{E_L} for changes in leverage.

However, to incorporate risky debt and for clarity of the comparison to the situation in which debt is rebalanced we will use equation (5).

B. The policy of rebalanced debt
The Hamada equation (2) and its more general form (5) are correct only for firms that maintain their debt level fixed following the capital structure change, regardless of possible future fluctuations/changes in the enterprise value. As described in the introduction, increasing evidence suggests that many firms do not keep the level of their debt fixed, but rather rebalance their debt to keep the firm's debt ratio fixed. For firms that are expected to rebalance their debt level with future fluctuations in the enterprise value to maintain their debt ratio fixed following the capital structure change, the unlevering and relevering procedure should be performed as described below (Oded and Michel, 2007b)[7].

Under the policy of rebalanced debt, the tax shield is as risky as the assets. To understand this argument, note that with rebalancing, debt still has the risk β_D (which is probably small because every dollar borrowed is likely to be repaid). However, as the asset value fluctuates, the firm adjusts its debt level and hence the tax benefit to the firm becomes risky. The risk of this benefit is the same as the risk of the assets because given rebalancing, the value of the tax shield is perfectly correlated with the value of the assets. Accordingly, with rebalanced debt $\beta_{TS} = \beta_U$, and hence $r_{TS} = r_U$. Unlike with the policy of fixed debt, β_{TS} is different from β_D (and is likely higher). Moreover, with a policy of rebalanced debt, a perpetuity of cash flows implies that the value of the tax shield in the accounting identity equation (3) is:

$$TS = \frac{\tau D r_D}{r_{TS}} = \frac{\tau D r_D}{r_U}.$$

We can thus write the accounting identity equation (3) as:

$$V_L = V_U + \tau D \frac{r_D}{r_U} = E_L + D \tag{7}$$

and note that this expression is different than equation (4). Now, since under debt rebalancing the beta of the tax shield is the same as the beta of the assets β_U, the beta of assets is not affected by leverage and equals β_U. Because the beta of a portfolio is the weighted average of the beta of its components, under the assumption that debt is rebalanced, we can write using equation (7) that:

$$\frac{V_U}{V_L} \beta_U + \frac{\tau D(r_D/r_U)}{V_L} \beta_U = \frac{D}{V_L} \beta_D + \frac{E}{V_L} \beta_{E_L}$$

or:

$$\beta_U = \frac{D}{V_L} \beta_D + \frac{E}{V_L} \beta_{E_L}.$$

We can further rearrange this using $V_L = E_L + D$ to obtain:

$$\beta_{E_L} = \frac{V_L \beta_U - D \beta_D}{(V_L - D)} = \frac{(E_L + D)\beta_U - D\beta_D}{E_L}$$

and further rearrange to obtain:

$$\beta_{E_L} = \beta_U + \frac{D}{E_L}(\beta_U - \beta_D).$$ (8)

Accordingly, using the CAPM:

$$r_{E_L} = r_U + \frac{D}{E_L}(r_U - r_D).$$ (9)

Observe that under the policy of rebalanced debt, the adjustment in equation (9) is different from that suggested in equation (6) which is the standard approach to adjust the WACC. This difference can be seen in the tax effect, namely $(1 - \tau)$.

## III. Fixed debt vs rebalanced debt: the effect on valuation

The differences in the way the WACC should be adjusted under the two alternative debt policies described above have important and significant effect on valuation. This section considers this effect and demonstrates it with a numerical example.

A. The valuation of an unlevered firm

Given the firm's expected perpetual cash flow, c_f, and corporate tax rate, τ, the value of the unlevered firm is calculated as:

$$V_U = \frac{c_f(1 - \tau)}{r_U}$$

where $r_U = r_f + \beta_U(\bar{r}_m - r_f)$. Figure 1 shows the manner in which the firm value will
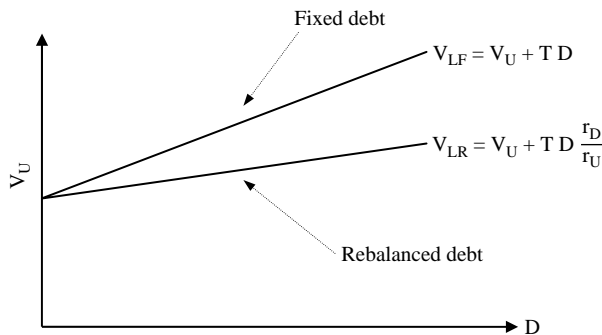
Notes: The x-axis represents the level of debt and the
y-axis represents the firm's value; V_U is the
known unlevered value of the firm; the two lines V_{LF}
and V_{LR} in the figure represent the manner in which the
value of this firm would change with leverage under
different debt rebalancing policies; the line with the
steeper slope, V_{LF}, depicts the value of the firm for
given debt financing D and a policy of fixed debt
(i.e. that the firm's policy is not to change its level of
debt with future fluctuations in its enterprise value);
the line with the more

Figure 1.
Levering an unlevered
firm under policies of fixed
debt and rebalanced debt

vary under the two alternative assumptions about debt rebalancing policy. Given the firm's unlevered value, V_U, its value increases with leverage at a greater rate under a policy of fixed debt than under the policy of rebalanced debt. Specifically, by inspection of equations (4) and (7), respectively, the firm value increases by τ for every additional $1 of debt financing with a policy of fixed debt, but only by $\tau(r_D/r_U)$ with a policy of rebalanced debt. Because $r_U > r_D$, the value of the tax shield under a policy of fixed debt is higher than the value of the tax shield under a policy of rebalanced debt. It is also important to notice that the higher the risk of a firm's assets, the higher the importance of the rebalancing policy. Namely, since the value of the tax shield under rebalanced debt policy is $\tau D(r_D/r_U)$, the higher the market risk of the assets, the higher r_U, and hence the lower the value of the tax shield under a policy of rebalanced debt, whereas under a policy of fixed debt policy, the value of the tax shield is τD and does not depend on the market risk of the assets. In the next section, we use a numerical example to demonstrate the process of levering an unlevered firm.

B. Example 1 – levering an unlevered firm
This example considers an unlevered firm and demonstrates the manner in which risk, return, and value change with leverage under the two alternative debt rebalancing policies. We first determine the value of the unlevered firm V_U given specific values of the expected perpetual cash flow c_f, the corporate tax rate τ, and risk of the firm's assets β_U. We then demonstrate the manner in which the value of the firm changes with leverage. In other words, we find V_L for a specific target debt. It is shown that, given the unlevered firm value V_U, the projected levered value V_L is higher under the policy of fixed debt than under the policy of rebalanced debt.

Consider a firm with a perpetual yearly cash flow from assets that has an expected value $c_f = \$1$. The firm has a corporate tax rate $\tau = 40$ per cent and the market risk of its assets $\beta_U = 1.2$. The risk-free rate $r_f = 3$ per cent and the market premium $\bar{r}_m - r_f = 8$ per cent. Assume first that the firm is entirely equity financed. From the CAPM, we have:

$$r_U = r_f + \beta_U(\bar{r}_m - r_f) = 3 + 1.2*8 = 15\%$$

and accordingly:

$$V_U = \frac{c_f(1 - \tau)}{r_U} = \frac{0.6}{0.15} = 4.$$

Now, suppose the firm is considering levering up to $D/V = 0.6$. Suppose further that the firm assumes debt with $\beta_D = 0.1$. Then:

$$r_D = r_f + \beta_D(\bar{r}_m - r_f) = 3 + 0.1*8 = 3.8\%.$$

We will now consider the two alternative assumptions about the firm's debt rebalancing policy. The first assumes that the firm keeps its debt level fixed (no debt rebalancing) and the second assumes that the firm rebalances its debt with future fluctuations of the value of the assets to keep the debt ratio fixed.

1. A policy of fixed debt. We illustrate how value should be calculated given a policy of fixed debt. Consider a firm that changes its capital structure from pure equity financing to a debt ratio $D/V = 0.6$ and maintains a fixed debt level thereafter.

Using equation (6), r_{E_L} is then calculated as:

$$r_{E_L} = r_U + (1 - \tau)(r_U - r_D)\frac{D}{E_L} = 15 + 0.6 * 11.2 * \frac{0.6}{0.4} = 25.1\%.$$

Upon substitution of r_{E_L} into the WACC equation under the policy of fixed debt, WACC is calculated as:

$$r_W = \frac{D}{V_L}(1 - \tau)r_D + \frac{E}{V_L}r_{E_L} = 0.6 * 0.6 * 3.8 + 0.4 * 25.08 = 11.4\%.$$

This WACC is then used to determine the firm's value, V_L, as:

$$V_L = \frac{c_f(1 - \tau)}{r_W} = \frac{0.6}{0.114} = 5.26.$$

2. A policy of debt rebalancing. Instead of assuming that the firm adopts a policy of fixed debt, we now assume that the firm adopts a policy of rebalancing its debt. Specifically, we assume that after the firm changes from pure equity financing to a debt ratio $D/V = 0.6$, it will rebalance its debt with future fluctuations in its enterprise value to keep the debt ratio fixed at 0.6. In other words, rather than adopting a policy of fixed debt, the firm will rebalance its debt. Under this alternative assumption, we then revisit example 1. In doing so, we recalculate the risk (betas), the discount rates, and the valuation. We demonstrate that under the policy of rebalanced debt the results are different than those calculated above under the policy of fixed debt.

After changing from pure equity financing to a debt ratio $D/V = 0.6$ under the policy of rebalanced debt, the firm will rebalance its debt with future fluctuations in the enterprise value to keep the debt ratio fixed. Then, using equation (9), r_{E_L} is calculated at the desired debt ratio $D/V = 0.6$ as:

$$r_{E_L} = r_U + \frac{D}{E_L}(r_U - r_D) = 15 + \frac{0.6}{0.4} * 11.2 = 31.8\%.$$

Upon substitution of r_{E_L} into the WACC equation, the WACC under the policy of fixed debt is calculated to be:

$$r_W = \frac{D}{V_L}(1 - \tau)r_D + \frac{E}{V_L}r_{E_L} = 0.6 * 0.6 * 3.8 + 0.4 * 31.8 = 14.1\%.$$

The WACC is then used to find the value of the levered firm V_L:

$$V_L = \frac{c_f(1 - \tau)}{r_W} = \frac{0.6}{0.141} = 4.26.$$

The reason r_W under the policy of rebalanced debt (14.1 per cent) is higher than under the policy of fixed debt (11.2 per cent) is that the value of the tax shield is relatively lower under the policy of rebalanced debt. Hence, the discount rate that takes us from the cash flow of an unlevered firm to the value of the levered firm must be higher under the policy of rebalanced debt than under the policy of fixed debt. Note also that consistent with Figure 1, the levered value calculated under a policy of rebalanced debt (4.26) is lower

than the levered firm value calculated under the policy of fixed debt (5.26) because the value of the tax shield is lower. Given the target debt ratio, in this example, an analyst assuming a policy of fixed debt instead rebalanced debt, obtains a 24 per cent distortion in firm value.

IV. Sample of leverage increasing transactions

To demonstrate the difference in valuation between a policy of fixed debt and rebalanced debt, we consider a sample of firms that experienced a significant leverage increasing transaction. The sample is derived from the article "The price is REIT," that appeared in *The Wall Street Journal*, February 7, 2006, and consists of the ten LBOs through the date of publication. When the list is pared to eliminate one buyout from twenty years prior to the others on the list (RJR Nabisco) and one deal that is more accurately described as a merger than a buyout (Albertson's), the following eight firms remain: Equity Office Properties, HCA, Clear Channel, Harrah's Entertainment, Kinder Morgan, Freescale Semiconductors, Univision, and Sungard Data Systems. Given our interest in large leveraged buyouts, we also included TXU Corp. in our sample. It is the largest leveraged buyout in US history, and was announced approximately one year following the article sourcing the other buyouts in the sample.

For each of these firms, we first calculate the increase in debt that is associated with the leveraged buyout. Next we calculate the value of the new tax shield implied by the increase of debt under the policy of fixed debt and also under a policy of rebalanced debt[8]. The difference between these alternative valuations of the tax shield is then compared to the deal-based value of the target firm and to the pre-deal value of the equity. The results are summarized in Table I.

In Table I, deal value difference: fixed vs rebalanced debt is calculated as:

$$\Delta D\tau - \Delta D\tau \frac{r_D}{r_A} = \Delta D\tau \left(1 - \frac{r_D}{r_A}\right) \tag{10}$$

where ΔD is the new debt in deal, τ is the corporate tax rate, and r_D/r_A is the ratio of the cost of debt (equivalently, the expected return on debt) to the expected return on assets. The value of the new tax shield under a policy of fixed debt is $\Delta D\tau$, whereas the value of the new tax shield assuming a policy of rebalanced debt is $\Delta D\tau(r_D/r_A)$. The parameters in equation (10) are estimated as follows.

The increase in debt ΔD is estimated as the firm's post-deal debt value less the firm's pre-deal debt value. Debt value before the deal is obtained from the last financial statement before the announcement date. Debt value after the deal is obtained from the firm's proxy statement (DEFA14A filings to the SEC) which describes the proposed financing of the buyout.

We calculate the cost of debt r_D using the CAPM:

$$r_D = r_f + \beta_D(\bar{r}_m - r_f)$$

where the risk-free rate, r_f, is the ten-year treasury rate on the date of the deal. The empirical literature suggests that debt beta, β_D, is in the range 0-0.3, and hardly changes with leverage (Cornell and Green, 1991. Accordingly, we have assumed $\beta_D = 0.2$. We have used 7.5 per cent for the market premium, a premium in the range typically used in the valuation literature and in practice (Fernandez, 2007; Brealey *et al.*, 2008)[9].

(1) Target firm	(2) Date deal announced	(3) Announced deal value	(4) New debt in deal	(5) Value difference: fixed vs rebalanced debt	(6) Value difference as a per cent of announced deal value	(7) Value difference as a per cent of pre-deal equity
Equity Office Properties	November 20, 2006	36.00	13.60	1.55	4.9	11.1
HCA Inc.	July 24, 2006	33.00	16.00	1.39	4.8	9.9
Clear Channel	November 16, 2006	26.00	12.50	1.32	5.8	8.7
Harrah's Entertainment	October 2, 2006	25.75	9.18	1.50	6.7	14.7
Kinder Morgan	May 29, 2006	22.40	6.70	0.95	4.8	11.7
Freescale Semiconductors	September 15, 2006	18.60	10.45	2.38	14.7	22.6
Univision	June 27, 2006	13.70	8.40	1.41	11.8	14.7
Sungard Data Systems	March 28, 2005	11.70	7.70	1.17	11.4	14.6
TXU Corp.	February 26, 2007	45.00	24.50	3.36	7.5	12.2

Notes: The table lists the target firm, the day of announcement, the value of the firm implied by the deal, the new debt assumed in the deal, and the difference in value of the transaction under fixed vs rebalanced debt; the last two columns express this difference in value as percentage of the announced deal and the pre-deal equity value; deal value is the value of the deal based on the firm's announcement; this is the value that is reflected in the announced purchase price of the equity; new debt in deal is the net change in debt as a result of the deal; this is the difference between the amount of debt before the deal and the amount of debt after the deal; value difference: fixed vs rebalanced debt is the difference in the value of the tax shield under the policy of fixed debt less the value of the tax shield under the policy of rebalanced debt; this difference accrues to the firm's equity value; value difference as per cent of deal value is the difference in tax shield under the policy of fixed debt and a policy of rebalanced debt as a percentage of the firm value reflected in the announcement of the deal; the firm value is based on the price offered for the firm's equity; value difference as per cent of equity value is the difference in tax shield under the policy of fixed debt and a policy of rebalanced debt as a percentage of the market value of equity one month before the announcement of the deal

Table I.
Transaction value under fixed debt vs rebalanced debt in the LBOs of the current decade

We calculate the return on assets, r_A, using the CAPM:

$$r_A = r_f + \beta_A(\bar{r}_m - r_f)$$

The same risk-free rate and market premium that are used in the calculation of r_D are assumed. The parameter β_A is estimated as the weighted average of the betas of the debt and equity[10]:

$$\beta_A = \frac{D}{V} \beta_D + \frac{E}{V} \beta_{E_L}$$

We find β_{E_L} from CRSP based on daily returns, from one year prior to the year of the deal, and β_D is identical to that used in the calculation of r_D above. We estimate D and E based on pre-deal values. Here, D is from the last financial statement before the deal announcement date, and E is the value of the equity before the deal, and is calculated based on the number of shares from the last financial statement before the announcement date times the stock price recorded in CRSP one month before the announcement date. Lastly, we use $V = D + E$. While we have used pre-deal values in the estimation of β_A, the resulting beta is a reasonable proxy for the post-deal beta of assets, since under leveraging, the asset beta does not change.

Our analysis of the leveraged buyout sample includes three different measures of the difference in valuation under the two alternative debt rebalancing policies (fixed debt and rebalanced debt). The results calculated under these measures are reported in columns 5-7 of Table I. The first measure is the (absolute) difference in valuation (column 5 in the table). The difference in valuation, as described in equation (10), depends primarily on the increase in debt arising from the transaction, the tax rate, and the riskiness of the assets[11]. The firm with the most significant difference in valuation according to this measure is TXU Corp. with $3.36 billion difference in the valuation, followed by Equity Office Properties with $1.5 billion difference in the valuation. The firm with the least significant difference is Kinder Morgan with only $0.95 billion difference in the valuation.

The second measure we use is the (absolute) difference in valuation relative to the announcement-based deal value (column 6 in the table). According to this measure, the firm with the most significant difference in valuation is Freescale Semiconductors (14.7 per cent), followed by Univision (11.8 per cent). Using this measure, Univision replaces Equity Office Properties due to Univision's relatively smaller deal size. The firms with the least significant difference relative to the deal size are HCA and Kinder Morgan (both at 4.8 per cent).

The third measure we use is the absolute difference in valuation relative to the pre-deal value of the equity (last column in the table). This difference depends both on the absolute difference in valuation between the policies of fixed and rebalanced debt and the pre-deal capital structure of the firm. Here, the firm with the most significant difference is Freescale Semiconductors (22.6 per cent) followed by Harrah's Entertainment (14.7 per cent). The firm with the least significant difference is Clear Channel (8.7 per cent). Using this measure, Harrah's Entertainment and Clear Channel replaced their respective counterparts in earlier measures because of their relatively higher pre-deal equity financing. Similarly, Clear Channel replaces HCA and Kinder Morgan because of its lower pre-deal equity value.

The above findings suggest that for substantial leverage increasing transactions, the distortion associated with making the wrong debt policy assumption may be large.

In our sample, this distortion was in the range of 8.7-22.6 per cent of the pre-deal equity value. In particular, given the large market value of the firms we considered, the corresponding dollar value ranged between $0.95 and $3.36 billion. The magnitude of these distortions suggests that the rebalancing policy is relevant for analysts charged with determining the firm's equity value in highly levered transactions.

Given the conflicting empirical finding on whether firms rebalance their debt, discussed in the introduction:

> [...] the true value of the typical firm lies probably somewhere in between that determined under each of the extreme assumptions: a policy of a fixed debt level or a fixed debt ratio (Oded and Michel, 2007a).

Accordingly, the implied distortion of the valuation relative to the announced deal value is likely to be between 0 per cent (no distortion) and 8 per cent (the average distortion calculated from column 6 of Table I); the implied distortion of the valuation relative to the pre-deal equity value is likely to be between 0 per cent (no distortion) and 13.4 per cent (the average distortion calculated from column 7 of Table I). Of course, leverage changes that are smaller than those considered in Table I imply less distortion.

While most leveraged buyout firms declare their intention to "grow out of their debt," clearly indicating that their policy is not to rebalance, we are unable to verify whether these firms follow through with their declared intention. This is both because the transactions considered are relatively recent, and because once a firm becomes private, the value of its debt and equity are not observable or measurable using publicly available information. Further research might consider leveraged buyout transactions that later went public (reverse LBO), since once such a firm becomes public, it posts financial data – including debt levels – for the preceding five years[12] (for example, HCA which went private in 2006 announced on April 7, 2010 its intention to do an IPO). Such a sample of reverse LBOs, might be subject to selection bias, since firms that experienced a leveraged buyout but did not go public again will be obviously excluded from the sample. In addition, one could analyze the rebalancing policy of a sample of public firms and investigate whether, other things equal, the market assigns higher valuations to firms that have a policy of fixed debt relative to a policy of rebalanced debt. Given that the empirical evidence is inconclusive about rebalancing policy, it would also be interesting to investigate what determines this policy. For example, is the rebalancing policy industry dependent, and if so, why? Does the policy relate to cash flow volatility and/or stock price volatility? These too are interesting directions for further research.

V. Conclusion
In this paper, we have reviewed and compared the valuation procedure of firms that change their capital structure under the alternative policies of fixed debt and rebalanced debt. Our analysis demonstrates that the standard valuation procedure is correct only for firms that are expected to maintain a fixed level of debt following the capital structure change. We show that for firms that are expected to rebalance their debt after the capital structure change another procedure must be used. We also show that failing to choose the appropriate valuation procedure can result in significant distortion of the valuation. In particular, we consider the difference in value for a sample of the LBOs of the current decade under the policies of fixed and rebalanced debt and demonstrate that this difference is significant.

Notes

1. Capital structure changes are frequently associated with buyouts through private equity activity and stock buybacks. On the growth in private equity activity, see for example, *Fortune*, January 22, 2007 pp 21-22; Boulton *et al.* (2006) and Mehran and Peristiani (2010). On the growth in stock buybacks see, for example, Grullon and Michaely (2002).

2. The credit crisis of 2007 may have dramatically reduced the number of buyouts. However, recent evidence in 2010 suggest that buyouts are beginning to reappear.

3. While we demonstrate the valuation procedure using the free cash flow method (WACC), it is possible to show that all other common calculation methods (APV, cash flow to equity, and CCFs (Ruback, 2002) lead to the same value if the debt rebalancing assumption is made consistently (Oded and Michel, 2007a).

4. The cost of debt r_D is generally assumed not to change with leverage. This assumption is plausible since the market risk of the debt, β_D, is not sensitive to the level of debt unless the leverage is increased to an extremely high level at which bankruptcy becomes an issue.

5. Our use of the word assets refers to all assets excluding the tax shield (i.e. traditional balance sheet assets).

6. We assume the firm always has sufficient earnings to obtain the tax credit. In practice, even if the firm generates a net loss, this loss might still be offset against past/future profits so that the interest tax shield is not lost. However, in practice, bankrupt firms do not pay interest and thus do not get the tax shield. Interest rate risk affects debt value and tax shield in a similar manner.

7. Adjustment for non-fixed has debt been considered earlier in the academic literature (Miles and Ezzell, 1985; Taggart, 1991; Arzac, 1996; Ruback, 2002).

8. The tax rate used to determine the tax shield was 40 per cent, reflecting the federal corporate tax rate plus a small increment resulting from additional state corporate taxes.

9. Note that the cost of debt is the expected return on debt and not the yield as is sometimes wrongly assumed by practitioners. The expected return on debt is lower the yield because the yield discounts promised payments not expected payments, whereas the DCF valuation method is based on expected cash flows, not promised cash flows. Because expected cash flows are lower than promised cash flows, the cost of debt is lower than yield. In practice, there are also call provisions on high yield debt which make the cost even lower.

10. The estimation of the parameter β_A depends on the assumption whether debt is fixed or rebalanced. Under the policy of rebalanced debt, β_A is the weighted average of the betas of the debt and equity. Under the assumption of fixed debt, the Hamada (1972) equation should be used if $\beta_D = 0$. If not, equation (5) should be used. For our analysis, β_A is needed only for the calculation of the value of the tax shield under a policy of rebalanced debt.

11. In equation (10) the variation of the term r_D/r_A across the different firms is determined mostly by the risk of the assets through β_A, because β_D is hardly affected by leverage (see discussion therein).

12. For more on reverse LBOs, see Kosedag *et al.* (2009).

References

Adsera, X. and Vinolas, P. (2003), "FEVA: a financial and economic approach to valuation", *Financial Analysts Journal*, Vol. 59, pp. 80-7.

Alti, A. (2006), "How persistent is the impact of market timing on capital structure?", *Journal of Finance*, Vol. 61, pp. 1681-710.

Arzac, E. (1996), "Valuation of highly leveraged firms", *Financial Analysts Journal*, Vol. 52, pp. 42-50.

Baker, M. and Wurgler, J. (2002), "Market timing and capital structure", *Journal of Finance*, Vol. 57, pp. 1-30.

Boulton, T., Lehn, K. and Segal, S. (2006), "The rise of the private equity market", working paper, Washington, DC.

Brealey, R., Myers, M. and Allen, F. (2008), *Principles of Corporate Finance*, 9th ed., McGraw-Hill, New York, NY.

Bruner, R. (2004), *Applied Mergers and Acquisitions*, Wiley, Hoboken, NJ.

Chang, X. and Dasgupta, S. (2009), "Target behavior and financing: how conclusive is the evidence?", *Journal of Finance*, Vol. 64, pp. 1767-96.

Cohen, G. and Yagil, Y. (2007), "A multinational survey of corporate financial policies", *Journal of Applied Finance*, Vol. 17, pp. 57-69.

Cornell, B. and Green, K. (1991), "The investment performance of low-grade bond funds", *Journal of Finance*, Vol. 46, pp. 29-48.

Damodaran, A. (2002), *Investment Valuation*, Wiley, New York, NY.

Damodaran, A. (2011), *Applied Corporate Finance*, Wiley, New York, NY.

Emery, D., Finnerty, J. and Stowe, J. (2007), *Corporate Financial Management*, 3rd ed., Prentice-Hall, Upper Saddle River, NJ.

Fama, E. and French, K. (2002), "Testing trade off and pecking order predictions about dividends and debt", *Review of Financial Studies*, Vol. 15, pp. 1-33.

Fernandez, P. (2007), "Equity premium: historical, expected, and required", SSRN working paper, SSRN, Barcelona.

Graham, J. (2000), "How big are the tax benefits of debt?", *Journal of Finance*, Vol. 40, pp. 1901-41.

Graham, J. and Harvey, C. (2001), "The theory and practice of corporate finance: evidence from the field", *Journal of Financial Economics*, Vol. 60, pp. 187-243.

Grullon, G. and Michaely, R. (2002), "Dividends, share repurchases, and the substitution hypothesis", *Journal of Finance*, Vol. 57, pp. 1649-84.

Hamada, R. (1972), "The effect of the firm's capital structure on the systematic risk of common stocks", *Journal of Finance*, Vol. 27, pp. 435-52.

Hull, R. (2007), "A capital structure model", *Investment Management and Financial Innovations*, Vol. 4, pp. 8-24.

Korteweg, A. (2010), "The net benefits of leverage", *Journal of Finance*, Vol. 65.

Kosedag, A., Mehran, J. and Qian, J. (2009), "Reverse-LBOs, re-LBOs and informational asymmetry hypothesis of LBO transactions", *Managerial Finance*, Vol. 35, pp. 716-28.

Leary, M. and Roberts, M. (2005), "Do firms rebalance their capital structure?", *Journal of Finance*, Vol. 54, pp. 2575-619.

Mehran, H. and Peristiani, S. (2010), "Financial visibility and the decision to go private", *Review of Financial Studies*, Vol. 23, pp. 519-47.

Miles, J.A. and Ezzell, J.R. (1985), "Reformulating tax shield valuation: a note", *Journal of Finance*, Vol. 40, pp. 1485-92.

Modigliani, F. and Miller, M. (1963), "Corporate income taxes and the cost of capital: a correction", *American Economic Review*, Vol. 53, pp. 433-43.

Oded, J. and Michel, A. (2007a), "Avoiding distortion in corporate valuation litigation: an application of discounted cash flow", *Journal of Forensic Economics*, Vol. 20, pp. 31-48.

Oded, J. and Michel, A. (2007b), "Reconciling DCF valuation methodologies", *Journal of Applied Finance*, Vol. 17, pp. 21-32.

Ross, S., Westerfield, R. and Jaffe, J. (2005), *Corporate Finance*, 7th ed., McGraw-Hill, New York, NY.

Ruback, R. (2002), "Capital cash flows: a simple approach to valuing risky cash flows", *Financial Management*, Vol. 31, pp. 5-30.

Taggart, R. (1991), "Consistent valuation and the cost of capital expressions with corporate and personal taxes", *Financial Management*, Vol. 20, pp. 8-20.

Welch, I. (2004), "Capital structure and stock returns", *Journal of Political Economy*, Vol. 112, pp. 106-31.

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