# Empirical research on mergers' leverage dynamics and post-merger integration duration

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Received 9 May 2018
Revised 19 July 2018
Accepted 16 August 2018

## Abstract

**Purpose** – The purpose of this paper is to examine the effects of the post-merger integration duration on acquiring firms' leverage behavior before and after a merger, using a dynamic model in which full merger benefits cannot be consumed at the instant of a merger, but rather after a pre-specified post-merger integration period.

**Design/methodology/approach** – This paper presents a dynamic model and empirical tests that describe the impact of the post-merger integration period on the capital structure dynamics of the acquiring and target firms prior to a merger and during the post-merger integration period. By incorporating costs associated with the post-merger integration period, the model can provide new implications for the leverage behavior around the merger.

**Findings** – Empirical tests support the model implications by showing that the longer the expected post-merger integration process, the less likely the acquirer will structure the financing of the combined firm in a manner that increases firm leverage. Since integration takes time to complete, an acquirer tends to retain financial flexibility during the integration process by assuming lower levels of debt when determining the capital structure of the merged entity.

**Originality/value** – The model generates new implications related to acquiring firms' leverage dynamics along with the method of payment choice. The analysis of the duration of the post-merger integration period extends both the theoretical and empirical literature that tacitly assumes that the merger-related synergy is realized immediately at the merger date. This is the first model in the literature that assumes that both the acquiring and the target firms can change their capital structure overtime, which allows us to analyze both the financing structure and the merger timing. Previous empirical studies also ignore the integration period in the analysis of the method of payment choice and leverage behavior around mergers. The model in this paper can be extended along a number of dimensions.

**Keywords** Mergers' leverage, Payment method, Post-merger integration duration

**Paper type** Research paper

## 1. Introduction

### *1.1 Research objectives*

The integration of two merging firms takes time to complete. We refer to this time lag between the initiation of the merger and its completion as the "post-merger integration duration" (PMID). This means that the synergy gains from the merger cannot be captured instantly at the merger date but rather only after the firms go through an integration/transition period. This period is often associated with temporarily higher costs and an elevated uncertainty about the merger success. Only after the post-merger integration is complete, can the newly merged firm fully enjoy the merger benefits. This merger integration period receives a great deal of attention among practitioners, but is largely ignored in both the theoretical and empirical literature on mergers. Annual reports of

**JEL Classification** — G32, G34



Managerial Finance
Emerald Publishing Limited
0307-4358
DOI 10.1108/MF-05-2018-0196

acquiring firms frequently discuss the challenges and difficulties firms may face during the integration period, such as possible problems in maintaining key employees, consolidating and rationalizing corporate infrastructures and eliminating redundant processes. There have been numerous reports of culture clashes, confusion and internal disruptions leading to declines in employee and customer satisfaction and loss of profitability. For these reasons, companies that expect a longer post-merger integration period may face temporarily higher expenses spread over a longer period coupled with higher operating risk. In turn, this expectation of long integration duration should directly affect an acquirer's decision when to merge, how to pay and most importantly the capital structure of the newly merged firm.

*1.2 Content*

This paper examines the effects of the PMID on acquiring firms' leverage behavior before and after a merger, using a dynamic model in which full merger benefits cannot be consumed at the instant of a merger, but rather after a pre-specified post-merger integration period. The model is built in continuous time with an infinite horizon framework that describes the leverage dynamics of two firms: the acquirer and the target. Each firm continuously generates earnings which depend on the price of its own product and its respective fixed production costs and taxes, which depend on the level of debt. The model implies that because earnings do not increase instantly upon the merger, there is no immediate need for additional tax shields, which can explain why firms that expect a longer integration period tend to use less debt. It should be stressed that the presence of the PMID is the necessary condition for optimal ratios being lower for the periods immediately following the merger.

The empirical section of the paper documents evidence that supports the model implications that the duration of the post-merger integration process significantly affects the leverage behavior of the merged firm before and after the year of merger. Starting with the universe of mergers that took place between 1999 and 2017, we select mergers in which we can gather data on the expected time for merger-related gains to materialize. Using this method, we come up with a sample of 3,120 mergers in which we can create the variable for the expected integration duration. For the sample we create a variable that measures the PMID. Specifically, for each merger, we manually read each 10-K filing, 8-K filing and merger-related proxy statements on Edgar Online and news stories from FACTIVA and search for information about the estimated timeline of cost savings and/or revenue enhancements. Because the model endogenizes both the capital structure decisions and the merger timing, it can also offer a rationale for several time-series observations around mergers.

*1.3 Innovation points of the research*

The model generates new implications related to acquiring firms' leverage dynamics along with the method of payment choice. The analysis of the duration of the post-merger integration period extends both the theoretical and empirical literature that tacitly assumes that the merger-related synergy is realized immediately at the merger date.

This is the first model in the literature that assumes that both the acquiring and the target firms can change their capital structure overtime, which allows us to analyze both the financing structure and the merger timing. For example, the related model in Morellec and Zhdanov's (2008) study presents the interaction between financial leverage and bidding contest. In their model, capital structure plays a role of a commitment device, which only determines the outcome of the acquisition contest, where the merger-related profits are realized immediately at the instant of merger. By contrast, our model predicts that the leverage of the winning bidder should be below the industry average and that acquirers should lever up after the takeover. These implications resonate with the implications of our model but they are based on different mechanisms.

Previous empirical studies also ignore the integration period in the analysis of the method of payment choice and leverage behavior around mergers. For example, Martin (2016) examines the motives underlying the method of payment in acquisitions and finds that the likelihood of stock financing increases with the acquirer's growth opportunities and higher pre-acquisition market and acquiring firm stock returns. In our tests, we control for the factors mentioned above and demonstrate that the expected integration duration is not subsumed by those variables implying that it has its own power in explaining the choice of leverage and merger financing method.

Compared with previous studies (e.g. Samitas and Kenourgios, 2007; Samitas *et al.*, 2008; Huang *et al.*, 2015), the model in this paper can be extended along a number of dimensions. First, we can assume that the initial bid for the target firm may not necessarily result in a successful merger due to possible bidding contests or uncertainty with respect to shareholders' approval. Also, one can endogenize the premium that the acquirer pays to the target firm. These types of extensions, while interesting, will not change the main implications of the paper.

### *1.4 Research framework*

The rest of the paper is organized as follows. In Section 2, we describe the model which offers new implications as well as economically plausible explanations to several stylized facts about the observed capital structures of mergers. In Section 3, we calculate and demonstrate valuation of target firm, merged firm and acquiring firm. In Section 4, we describe the base case parameters of the model. In Section 5, we test several predictions derived from the model. Section 6 concludes the model and empirical evidence on mergers' leverage and post-merger duration.

## 2. Description of the model

### *2.1 The earnings of the acquiring firm and the target firm*

The acquirer and the target firm continuously generate earnings by selling products whose unit market price, $p_1$ and $p_2$, respectively, evolve through time in the manner described by the following stochastic process:

$$\frac{dp_1}{p} = (\gamma - \alpha_1)dt + \delta_1 dW_1, \tag{1}$$

$$\frac{dp_2}{p} = (\gamma - \alpha_2)dt + \delta_2 dW_2, \tag{2}$$

where $W_1$ and $W_2$ are the Wiener processes under the risk-neutral measure $Q$; $\delta_1$ and $\delta_2$ the instantaneous volatility coefficients; $r$ the risk-free rate, which is assumed to be constant; and $\alpha_1$ and $\alpha_2$ ($> 0$) the convenience yields. The two Weiner processes are correlated, where corr ($W_1$, $W_2$) $= \rho$, and the instantaneous correlation $\rho$ is assumed to be constant.

The firm's instantaneous net earnings before interest and taxes (EBIT) are assumed to equal $p_1 - c_1$, and $p_2 - c_2$, respectively, for the acquirer and the target firm, where $c_1$ and $c_2$ are constants ($\geqslant 0$) that describe the continuous fixed production costs.

### *2.2 The net earnings of the merged firm*

As soon as the acquirer, which currently sells its product at price $p_1$, merges with the target firm, which sells its product at $p_2$, the merged firm begins selling both products of two firms and generate earnings of $p_1 + p_2$. The level of the combined production cost of the merged firm will depend on the length of the post-merger "integration period" $T$, over which the cost $c_3(\tau)$ will gradually decline from $c_3(T)$, at the initiation of the merger, to the level of $c_3(0)$, at the end of the integration period, where $\tau (0 < \tau \leqslant T)$ is remaining time until the integration

period is over. The combined production cost is assumed to be described by $c_3(\tau) = \overline{c} \cdot e^{\theta\tau/T}$, $0 < \tau \leqslant T$. At the initiation of the merger, $\tau = T$, the combined production cost is assumed to be higher than the total production costs of the two firms, i.e., $c_3(T) = \overline{c} \cdot e^{\theta T} > C_1 + C_2$. When the integration period is over, $\tau = 0$, the production costs decline to the level below the their combined pre-merger level, i.e., $c_3(0) = \overline{c} < C_1 + C_2$, and will stay at that level thereafter. Thus, during the integration period, the merged firm's instantaneous net EBIT is $p_1 + p_2 - c_3(\tau)$, if $0 < \tau \leqslant T$, and $p_1 + p_2 - \overline{c}$ thereafter.

### 2.3 Corporate taxes and dividends

For all firms, the net earnings after debt payments are taxed continuously at a constant corporate rate $\lambda$, and periodic debt coupon payments are tax deductible. The firms use their earnings to meet debt obligations and pay taxes, with any residual being paid out as a dividend. The firm's instantaneous tax obligation equals $(\lambda)\cdot[p_1 - d_1]$, $(\lambda)\cdot[p_2 - d_2]$, and $(\lambda)\cdot[p_1 + p_2 - c_3(\tau) - d_3]$ for the acquirer, the target and the merged firm, respectively, where $d_1$, $d_2$ and $d_3$ are the respective coupon payments. Thus, the firms instantaneous after tax dividends are the following:

$$(1-\lambda)\cdot\left[p_i - c_i - d_i\right],\ i \in \{1, 2\}, \tag{3a}$$

$$(1-\lambda)\cdot[p_1 + p_2 - c_3(\tau) - d_3],\ (0 < \tau \leqslant T). \tag{3b}$$

### 2.4 The debt structure and recapitalization

Similar to the assumptions in the studies of Fischer *et al.* (1989), Leland (1998) and Titman and Tsyplakov (2015), we assume that the acquiring and the target firms and the merged firm issue perpetual coupon debt with a periodic coupon payment $d_1$, $d_2$ and $d_3$, respectively. Following Leland (1998) and Tsyplakov (2008), we assume that firms can increase their debt ratio but not to decrease it. We assume that the firms can instantly increase its debt ratio by simultaneously repurchasing its total outstanding debt at its market value $D_i$ and issuing new debt with greater face value and a greater periodic coupon. For accounting purposes, we assume that the face value of the debt is $F_1 = (d_1/\mathrm{r})$, and $F_2 = (d_2/r)$, respectively, $F_3 = (d_3/r)$, which are the values of perpetual debt with a periodic coupon payment $d_1$, $d_2$ and $d_3$ discounted at the risk-free rate. Specifically, when the firm changes its debt level by replacing old debt that has a face value of $F_i = (d_i/r)$, with new debt that has a coupon $\widehat{d}_i$, and face value $\widehat{F}_i = (\widehat{d}_i/r)$, the firm has to pay transaction costs of:

$$TC_i^{\text{debt}} = C_i^{\text{debt}} \cdot \widehat{F}_i,\ i \in \{1, 2, 3\}, \tag{4}$$

where $C_i^{\text{debt}}$ is a constant parameter for each firm $i$. When the firm increases its debt, it receives the net proceeds of the debt issue, which the firm uses to repurchase equity.

### 2.5 Default

We assume that the acquiring firm, the target firm and the merged firm is in distress and is forced into bankruptcy if there are insufficient earnings to meet periodic debt payments, i.e., if $p_1 - c_1 < d_1$, $p_2 - c_2 < d_2$ and $p_1 + p_2 - c_3(\tau) < d_3$, respectively. In the event of default, the equityholders of firm $i$ get 0 value, and the debtholders recover the liquidation value of the firm $\overline{E}^i$ minus default costs $C_i^{\text{default}}$ proportional to $\overline{E}^i$, where $C_i^{\text{default}}$ is a constant parameter and $i \in \{1, 2, 3\}$. For simplicity, we assume that the liquidation value of the firm equals the value of the unlevered firm $\overline{E}^i$ assuming that after default the firm cannot recapitalize. Thus, at default, the debt value of firm $i$ satisfies $D_i = (1 - C_i^{\text{default}})\cdot\overline{E}^i$ for $i \in \{1, 2, 3\}$.

*2.6 The merger transaction*

We assume that when the acquirer buys the target it has to pay a premium to the equityholders of the target firm, which is proportional to the total market value of the target firm's debt and equity $C^{\text{premium}} = \theta \cdot (D_2 + E_2)$, where $\theta$ is a positive constant.

## 3. Valuation

*3.1 Valuation of the equity and debt of the target firm*

For the target firm, its values of debt $D_2$ and equity $E_2$ at any period of time are functions of the state variables which include the price of its product $p_2$ and the level of the periodic coupon payment $d_2$. Since, by assumption, the target firm does not know that it will be acquired, the value of its equity and debt as well as its capital structure decisions does not depend on the merger possibility. Values for $D_2$ ($p_2$, $d_2$) and $E_2$ ($p_2$, $d_2$) can be determined by solving stochastic control problems with boundary conditions, determined by recapitalization decisions of the equityholders. The boundary conditions divide the state space ($p_2$, $d_2$) into three regions: the recapitalization region, no recapitalization region and the default region. Using standard arbitrage arguments of Merton (1974), in the "no recapitalization region," the equity value $E_2$ ($p_2$, $d_2$) is given by the solution to the following PDE:

$$E_2(p_2, d_2) = \max_{\widehat{d_2} > d_2} \left[ E\left(p_2, \widehat{d_2}\right) + D\left(p_2, \widehat{d_2}\right) - D(p_2, d_2) - TC_2^{\text{debt}} \right], \tag{5}$$

such that $E(p_2, \widehat{d_2}) \geq 0$, where $TC_i^{\text{debt}}$ are the transaction costs that were introduced earlier, $D(p_2, d_2)$ and $D(p_2, \widehat{d_2})$ are the market value of old and new debt, respectively. The amount $D(p_2, \widehat{d_2}) - D(p_2, d_2)$ is paid to current equityholders for the portion of their shares that are repurchased.

*3.2 Valuation of the equity and debt of the merged firm*

The values of debt $D_3$ and equity $E_3$ of the merged firm are functions of the prices of two products $p_1$ and $p_2$, the level of the periodic coupon payment $d_3$ and the remaining post-merger integration period $\tau$ which, in turn, determines the level of production costs $c_3(\tau)$. The values for $D_2(p_1, p_2, d_3, \tau)$ and $E(p_1, p_2, d_3, \tau)$ can be determined by solving stochastic control problems with boundary conditions associated with the firm's recapitalization decisions and its default. In the "no recapitalization region," the equity value $E_2(p_1, p_2, d_3, \tau)$ is given by the solution to the following PDE:

$$\begin{cases} \frac{1}{2}(\sigma_1)^2 (p_1)^2 \frac{\partial^2 E_3}{\partial p_1 \partial p_1} + \frac{1}{2}(\sigma_2)^2 (p_2)^2 \frac{\partial^2 E_3}{\partial p_2 \partial p_2} + \rho \sigma_1 \sigma_2 \frac{\partial^2 E_3}{\partial p_1 \partial p_2} \\ + (\gamma - \alpha_1) p_1 \frac{\partial E_3}{\partial p_1} + (\gamma - \alpha_2) p_2 \frac{\partial E_3}{\partial p_2} - \frac{\partial E_3}{\partial \gamma} - \gamma E_3 + (1-\lambda)(p_1 - p_2 - c_3(\tau) - d_3) = 0 \\ 0 < \tau \leq T, \text{ i.e. the merger firm is still in its "integration period"} \\ \frac{1}{2}(\sigma_1)^2 (p_1)^2 \frac{\partial^2 E_3}{\partial p_1 \partial p_1} + \frac{1}{2}(\sigma_2)^2 (p_2)^2 \frac{\partial^2 E_3}{\partial p_2 \partial p_2} + \rho \sigma_1 \sigma_2 \frac{\partial^2 E_3}{\partial p_1 \partial p_2} \\ + (\gamma - \alpha_1) p_1 \frac{\partial E_3}{\partial p_1} + (\gamma - \alpha_2) p_2 \frac{\partial E_3}{\partial p_2} - \gamma E_3 + (1-\lambda)(p_1 - p_2 - \bar{c} - d_3) = 0 \\ \tau = 0, \text{ the integration period is over.} \end{cases}$$

The payout flow $(1-\lambda)$ $(p_1 - p_2 - c_3(\tau) - d_3)$ is the firm's instantaneous after tax dividends, where $c_3(\tau) = \bar{c} \cdot e^{\theta \tau}$ is the cost during the integration period. The derivative term $-(\partial E_3 / \partial \gamma)$ in the first equation represents a linear decrease in the remaining integration period $\tau$, when $0 < \tau \leq T$. The description of the boundary conditions is similar to the description in the previous section. The firm recapitalizes from debt with coupon $d_3$ to some,

$\widehat{d_3}(d_3 < \widehat{d_3})$ only if the net increase in equity value exceeds transaction costs, and its equity must satisfy:

$$E_3(p_1, p_2, d_3, \tau) = \max_{\widehat{d_3} > d_3} \left[ E_3\left(p_1, p_2, \widehat{d_3}, \tau\right) + D_3\left(p_1, p_2, \widehat{d_3}, \tau\right) - D_3(p_1, p_2, d_3, \tau) - TC_3^{\text{debt}} \right], \tag{6}$$

for any $p_1, p_2, d_3, \widehat{d_3}$, and $\tau$ such that $E_3(p_1, p_2, \widehat{d_3}, \tau) > 0, \widehat{d_3} > d_3$, where $TC_3^{\text{debt}}$ is the transaction costs that were introduced earlier; $D_3(p_1, p_2, d_3, \tau)$ and $D_3(p_1, p_2, \widehat{d_3}, \tau)$ the market values of old and new debt, respectively. In the default region, if $p_1 - p_2 - c_3(\tau) < d_3$, the equity value is 0 (Figure 1).

### 3.3 Valuation of the equity and debt of the acquiring firm

The value of equity $E_1$ of the acquiring firm (before the merger) is a function of not only the price of its own product $p_1$ and the level of its debt payment $d_2$, but also of the product price $p_2$ of the target firm and its payment $d_2$. The value $E_2$ can be determined by solving stochastic control problems with boundary conditions associated with the firm's recapitalization decisions, its merger decision and its default. If the firm is not recapitalizing, its equity value $E_2(p_1, d_1, p_2, d_2)$ is given by the solution to the following PDE:

$$\frac{1}{2}(\sigma_1)^2(p_1)^2\frac{\partial^2 E_1}{\partial p_1 \partial p_1} + \frac{1}{2}(\sigma_2)^2(p_2)^2\frac{\partial^2 E_1}{\partial p_2 \partial p_2} + p\sigma_1\sigma_2\frac{\partial^2 E_1}{\partial p_1 \partial p_2} + (\gamma - \alpha_1)p_1\frac{\partial E_1}{\partial p_1}$$
$$+ (\gamma - \alpha_2)p_2\frac{\partial E_1}{\partial p_2} - \gamma E_1 + (1-\lambda)(p_1 - c_1 - d_1) = 0.$$

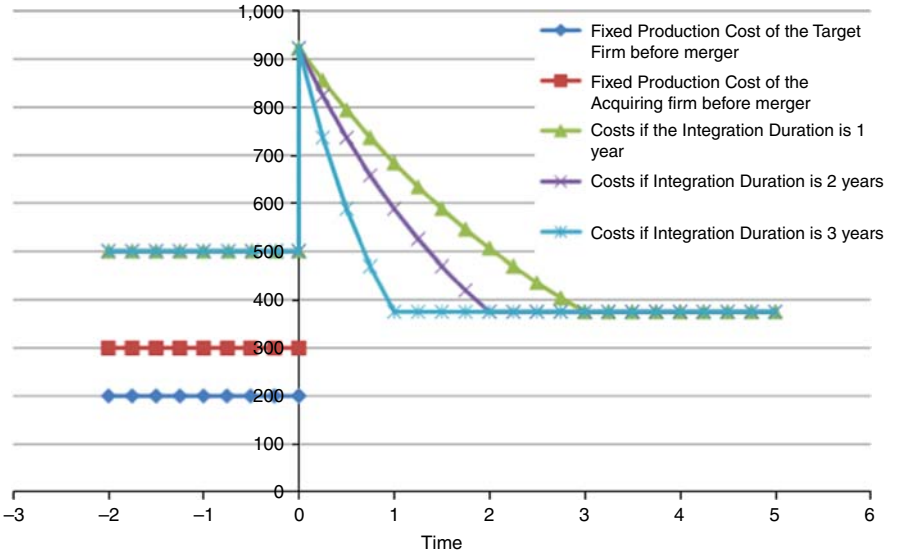


**Figure 1.** Production costs of the target firm and acquiring firm before the merger, and the combined costs of the merged firm after the merger

**Notes:** This figure depicts the production costs of the firms as a function of the time since the merger. Time of 0 is the time of the merger initiation. The cost function is depicted for the Integration Duration of 1, 2 and 3 years

The firm will optimally decide to merge only if the net increase in equity value of the acquiring firm exceeds the values paid to the debtholders and equityholders of the target plus transaction costs. The acquiring firm will merger with the target as soon as:

$$E_1(p_1, d_1, p_2, d_2) < \max_{\widehat{d_3} \geq d_1 + d_2} \left[ E_3\left(p_1, p_2, \widehat{d_3}, T\right) + E_2(p_2, d_2) - \frac{d_2}{\gamma} - D_1(p_1, d_1) \right.$$

$$\left. + D_3\left(p_1, p_2, \widehat{d_3}, T\right) - C^{\text{premium}} \right],$$

for $p_1, p_2, \widehat{d_3}$, such that:

$$E_3\left(p_1, p_2, \widehat{d_3}, T\right) > 0,\ E_1(p_1, d_1, p_2, d_2) > E_2(p_2, d_2),\ \text{and}\ E_1(p_1, d_1, p_2, d_2)$$

$$+ D_1(p_1, d_1) > E_2(p_2, d_2) + D_2(p_2, d_2),$$

where $E_3(p_1, p_2, \widehat{d_3}, T)$ and $D_3(p_1, p_2, \widehat{d_3}, T)$ are the equity value and the debt values of a merged firm, the amount $(d_2/\gamma)$ and $D_1(p_1, d_1)$ are the values that paid to the debtholders of the target and the acquirer at the initiation of the merger. A value of $C^{\text{premium}} = \theta \cdot (E_2(p_2, d_2) + D_2(p_2, d_2))$ is a premium (proportional to the value of the target) that the acquirer pays to the shareholders of the target firm. $T$ in the value function of $E_3$ and $D_3$ reflects the fact that, at the initiation of the merger, the remaining "integration period" is $T$. The last two conditions account for the fact that a smaller acquirer is prohibited from acquiring a larger target, i.e. when the acquirer's equity capitalization (i.e. its equity values) or its total value (i.e. total value of debt plus equity) are less than those of the target.

## 4. Model implications

### *4.1 Base case parameters*

The model parameters are chosen to roughly match empirical observations for manufacturing firms. The volatility of the product prices $\sigma_1$ and $\sigma_2$ is set at 20 percent. The correlation coefficient between the two Weiner processes $\rho$ that describe earnings of the two firms is assumed to be 0.2. The convenience yield $\alpha_1$ and $\alpha_2$ is set at 7 percent. The risk-free interest rate is set to $r = 7$ percent, this means that the risk-neutral drift of the product prices is 0. Fixed operating costs is $c_1 = \$300$ and $c_2 = \$200$, $i \in \{1, 2\}$. For the base case we assume that the integration duration $T$ is 2 years (the median value from our empirical tests that follows). We also consider comparative statics for the integration duration of $T = 1$ and $T = 3$ years.

### *4.2 Implications of the model for base case parameters*

*4.2.1 Trade-offs that the acquiring firm faces in its decision to merge.* The acquiring firm's decisions are complex because the firm has to simultaneously maximize the values of two options: the option to increase its debt level and reduce its taxable income, and the timing option as to when to initiate the merger. These two options depend on the size of its own earnings $p_1$, the level of its own debt $d_1$ as well as the earnings of the target $p_2$ and the target's level of debt $d_2$. In this decision, the acquiring firm faces trade-offs and the options affect each other. On the one hand, if the acquiring firm increases its leverage it can reduce the present value of its tax obligations. On the other hand, higher leverage will likely reduce the value of the merger option, because an acquirer with higher leverage will be less optimally prepositioned to merge. By assumption, the benefits of the merger do not directly depend on the earnings size of the target firm, the acquiring firm with earnings significantly higher than costs will not initiate a merger.

*4.2.2 Decision to merge*. Table I reports the decision to merge/not to merge of the acquirer as a function of its earnings and the earnings of the target firm, for three different levels of its own debt payments $d_1 = 120$, $d_1 = 160$ and $d_1 = 180$, as well for the target firm's debt payment of $d_2 = 0$, $d_2 = 40$, $d_2 = 80$, $d_2 = 120$ and $d_2 = 160$. For the variable values that are outside this range, the acquirer will not start the merger.

In Table I, we hold the earnings of the target firm constant ($p_2 = 800$). The results in the table imply that the acquirer does not initiate the merger if the target firm's debt is above 120 for any level of the target's earnings $p_1$. This is because the acquirer is less willing to guarantee the target's debt if it is of a relatively large size. For example, if the earnings of the target firm are $p_2 = 800$, the optimal leverage is 30 percent ($d_2 = 251$). At such a level of debt, the acquiring firm will not initiate the merger. If the target firm's leverage is 17 percent or lower (debt payment $d_2 < 85$) which is significantly below its optimal level, then the acquirer would initiate the merger. This implication of the model suggests that firms that are underleveraged are more likely become a target of acquisitions. In other words, the leverage of the target firm observed at the instant of the merger tends to be lower than the optimal leverage of similar firms. This is due to the optimal timing on the part of the acquirer that will optimally choose (or wait for) to acquire the target firm that has a lower leverage.

*4.2.3 The optimal leverage choice of the acquiring firm at the merger time*. The optimal leverage decision of the acquiring firm is complex and it depends on the value of the merger option. Table II reports the optimal leverage of the acquirer and an otherwise identical firm that has no option to merge, as a function and its earnings $p_1$, keeping the earnings ($p_2 = 800$) and the debt level ($d_2 = 0$) of the target firm constant. For example, if the otherwise identical firm has no option to merge and its earnings are $p_1 = 1{,}200$, the optimal debt level (i.e. the leverage to which the firm would instantly recapitalize to) corresponds to 42 percent. For comparison, the acquirer's optimal leverage is about 20 percent. This result demonstrates that, in periods prior to an acquisition, an acquiring firm will optimally choose lower leverage ratios relative to its peers. This lower leverage of the acquirer tends to be interpreted in the related literature as being driven by the managerial empire-building incentives. The model shows that, due to an anticipated delay in capturing merger-related gains, an acquiring firm should rationally preposition itself by choosing lower leverage immediately before initiating a merger.

## 5. Empirical tests

In the following sections, we test several predictions derived from the model with a particular focus on the effect of integration duration on the leverage decision of the merging firms. We exclude 121 cases in which we do not have enough information to calculate one-year market-adjusted pre-merger acquirer abnormal returns and another six cases in which sales are missing in the probit regression. In the Tobit model, we exclude 9 cases in which the inverse Mill's ratios are missing, and 12 cases in which we cannot calculate the pre-merger leverage deviation.

### *5.1 Sample description*

The sample of mergers comes from the Securities Data Company's (SDC) US Mergers and Acquisition Database. We select domestic mergers with announcement dates between 1999 and 2017[1]. We only consider mergers in which acquirers end up with full control of the target firms and we also require that the acquirers control less than 50 percent of the target before the merger announcement. We further require that the merger is completed; the acquirer and the target are not in financial (SIC 6000–6999) and regulatory (4900–4999) industries; the acquirer is a public firm so that we have necessary Compustat data to compute relative size of target to acquirer market size; the deal value relative to the market

| Debt payment of the acquiring firm | Earnings of target firm | Earnings of the acquiring firm | Merger decision and debt decision (if merges) Debt payment of the target firm = 0 | W-A leverage | Merger decision and debt decision (if merges) Debt payment of the target firm = 40 | W-A leverage | Merger decision and debt decision (if merges) Debt payment of the target firm = 80 | W-A leverage | Merger decision and debt decision (if merges) Debt payment of the target firm = 120 | W-A leverage | Debt payment of the target firm = 160 | W-A leverage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 120 | 800 | 856 | – | – | – | – | – | – | | | | |
| 120 | 800 | 900 | – | – | – | – | – | – | | | | |
| 120 | 800 | 944 | – | – | – | – | – | – | | | | |
| 120 | 800 | 1,056 | – | – | – | – | – | – | | | | |
| 120 | 800 | 1,100 | Merge/raise debt | 0.097 | Merge/raise debt | 0.151 | Merge/keep debt | 0.196 | | | | |
| 120 | 800 | 1,144 | Merge/raise debt | 0.102 | Merge/raise debt | 0.145 | Merge/keep debt | 0.187 | | | | |
| 120 | 800 | 1,256 | Merge/raise debt | 0.101 | Merge/raise debt | 0.139 | Merge/raise debt | 0.177 | | | | |
| 120 | 800 | 1,300 | Merge/raise debt | 0.091 | Merge/raise debt | 0.132 | Merge/raise debt | 0.163 | | | | |
| 120 | 800 | 1,344 | Merge/raise debt | 0.087 | Merge/raise debt | 0.125 | Merge/raise debt | 0.158 | | | | |
| 120 | 800 | 1,456 | Merge/raise debt | 0.084 | Merge/raise debt | 0.115 | Merge/raise debt | 0.148 | | | | |
| 120 | 800 | 1,500 | Merge/raise debt | 0.076 | Merge/raise debt | 0.109 | Merge/raise debt | 0.132 | | | | |
| 120 | 800 | 1,544 | Merge/raise debt | 0.072 | Merge/raise debt | 0.103 | Merge/raise debt | 0.127 | | | | |
| 120 | 800 | 1,656 | Merge/raise debt | 0.070 | Merge/raise debt | 0.097 | | | | | | |
| 120 | 800 | 1,700 | – | – | – | – | – | – | | | | |
| 120 | 800 | 1,744 | – | – | – | – | – | – | | | | |
| 120 | 800 | 1,856 | – | – | – | – | – | – | | | | |

(*continued*)

**Table I.**
Decision of the acquiring firm to merge/not to merge if the post-merger integration duration is two years

Table I.

| Debt payment of the acquiring firm | Earnings of target firm | Earnings of the acquiring firm | Merger decision and debt decision (if merges) Debt payment of the target firm = 0 | W-A leverage | Merger decision and debt decision (if merges) Debt payment of the target firm = 40 | W-A leverage | Merger decision and debt decision (if merges) Debt payment of the target firm = 80 | W-A leverage | Merger decision and debt decision (if merges) Debt payment of the target firm = 120 | W-A leverage | Debt payment of the target firm = 160 | W-A leverage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 160 | 800 | 856 | – | – | – | – | – | – | | | | |
| 160 | 800 | 900 | – | – | – | – | – | – | | | | |
| 160 | 800 | 944 | – | – | – | – | – | – | | | | |
| 160 | 800 | 1,056 | – | – | – | – | – | – | | | | |
| 160 | 800 | 1,100 | – | – | Merge/keep debt | 0.192 | – | – | | | | |
| 160 | 800 | 1,144 | Merge/raise debt | 0.142 | Merge/keep debt | 0.186 | Merge/keep debt | 0.223 | | | | |
| 160 | 800 | 1,256 | Merge/raise debt | 0.139 | Merge/raise debt | 0.177 | Merge/raise debt | 0.217 | | | | |
| 160 | 800 | 1,300 | Merge/raise debt | 0.133 | Merge/raise debt | 0.173 | Merge/raise debt | 0.193 | | | | |
| 160 | 800 | 1,344 | Merge/raise debt | 0.127 | Merge/raise debt | 0.165 | Merge/raise debt | 0.180 | | | | |
| 160 | 800 | 1,456 | Merge/raise debt | 0.118 | Merge/raise debt | 0.161 | Merge/raise debt | 0.173 | | | | |
| 160 | 800 | 1,500 | Merge/raise debt | 0.116 | Merge/raise debt | 0.158 | Merge/raise debt | 0.161 | | | | |
| 160 | 800 | 1,544 | Merge/raise debt | 0.107 | Merge/raise debt | 0.153 | – | – | | | | |
| 160 | 800 | 1,656 | Merge/raise debt | 0.105 | – | – | | | | | | |
| 160 | 800 | 1,700 | – | – | – | – | – | – | | | | |
| 160 | 800 | 1,744 | – | – | – | – | – | – | | | | |
| 160 | 800 | 1,856 | – | – | – | – | – | – | | | | |

(*continued*)

Table I.

| Debt payment of the acquiring firm | Earnings of target firm | Earnings of the acquiring firm | Merger decision and debt decision (if merges) Debt payment of the target firm = 0 | W-A leverage | Merger decision and debt decision (if merges) Debt payment of the target firm = 40 | W-A leverage | Merger decision and debt decision (if merges) Debt payment of the target firm = 80 | W-A leverage | Merger decision and debt decision (if merges) Debt payment of the target firm = 120 | W-A leverage | Debt payment of the target firm = 160 | W-A leverage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 800 | 856 | – | – | – | – | – | – | | | | |
| 200 | 800 | 900 | – | – | – | – | – | – | | | | |
| 200 | 800 | 944 | – | – | – | – | – | – | | | | |
| 200 | 800 | 1,056 | – | – | – | – | – | – | | | | |
| 200 | 800 | 1,100 | – | – | – | – | Merge/keep debt | 0.254 | | | | |
| 200 | 800 | 1,144 | Merge/keep debt | 0.180 | Merge/keep debt | 0.213 | Merge/keep debt | 0.248 | | | | |
| 200 | 800 | 1,256 | Merge/raise debt | 0.177 | Merge/raise debt | 0.209 | Merge/raise debt | 0.236 | | | | |
| 200 | 800 | 1,300 | Merge/raise debt | 0.170 | Merge/raise debt | 0.197 | Merge/raise debt | 0.247 | | | | |
| 200 | 800 | 1,344 | Merge/raise debt | 0.168 | Merge/raise debt | 0.186 | Merge/raise debt | 0.230 | | | | |
| 200 | 800 | 1,456 | Merge/raise debt | 0.160 | Merge/raise debt | 0.177 | Merge/raise debt | 0.226 | | | | |
| 200 | 800 | 1,500 | Merge/raise debt | 0.155 | Merge/raise debt | 0.171 | Merge/raise debt | 0.215 | | | | |
| 200 | 800 | 1,544 | Merge/raise debt | 0.142 | Merge/raise debt | 0.168 | – | – | | | | |
| 200 | 800 | 1,656 | Merge/raise debt | 0.139 | – | – | – | – | | | | |
| 200 | 800 | 1,700 | – | – | – | – | – | – | | | | |
| 200 | 800 | 1,744 | – | – | – | – | – | – | | | | |
| 200 | 800 | 1,856 | – | – | – | – | – | – | | | | |

**Table II.**
Comparison between optimal leverage of the acquiring firm (post-merger integration duration is two years) and otherwise identical firm that has no option to merge

| Earnings of the acquiring firm, $p_1$ | Optimal leverage of the acquiring firm assuming there is no option to merge | Optimal leverage of the acquiring firm | Merger decision of the acquiring firm |
|---|---|---|---|
| 856 | – | – | – |
| 900 | – | – | – |
| 944 | – | – | – |
| 1,056 | – | – | – |
| 1,100 | 0.408 | 0.179 | Merge |
| 1,144 | 0.411 | 0.182 | Merge |
| 1,256 | 0.413 | 0.185 | Merge |
| 1,300 | 0.416 | 0.190 | Merge |
| 1,344 | 0.418 | 0.202 | Merge |
| 1,456 | 0.422 | 0.214 | Merge |
| 1,500 | 0.423 | 0.216 | Merge |
| 1,544 | 0.425 | 0.219 | Merge |
| 1,656 | 0.429 | 0.223 | Merge |
| 1,700 | – | – | – |
| 1,744 | – | – | – |
| 1,856 | – | – | – |

value of the acquirer is at least 18 percent[2], to eliminate the influence of very small acquirers and very small deals, we require that acquirers' CPI-adjusted market value of assets are larger than \$10m, and the transaction value of deals in our sample is at least \$19.5m. Our requirements leave us with a final sample of 3,527 successful mergers between 1999 and 2017.

We obtain managers' discussions about the merger deal from several data sources including annual 10-K filings, 8-K filings and merger-related proxy statements on Edgar Online and news stories from FACTIVA. In these data sources, we search for the information about managerial expectations as to when merger-related gains are expected to materialize in order to create the PMID variable. For each deal, we conduct a keyword search through the entire text of annual 10-K filings, 8-K filings and merger-related proxy statements from the fiscal year of merger announcement to the fiscal year of merger completion and identify all sections of text in which the integration process and expected merger gains are discussed. Using this approach, we are able to construct the PMID variable in 420 mergers (13.5 percent) from our initial sample. PMID ranges from 0.4 to 19 years with sample median of 2.7 years. There is some clustering with respect to the PMID variable.

Panel A of Table III reports the number of mergers in each PMID group. We find 155 cases in which PMID = 2 years. Therefore, we split the PMID subsample into three relatively even groups of PMID < 2 years, PMID = 2 years and PMID > 2 years, as shown in the table. Panel B of Table III shows that horizontal mergers consist of 53 percent of the PMID sample, and vertical mergers and diversifying mergers are 20 and 27 percent, respectively. Panel C of Table III describes the industry distribution for mergers in which we are able to create PMID. For each one-digit Standard Industrial Classification (SIC) code, we report the number of mergers during the entire sample period. While firms in the manufacturing industry have more observations with PMID reported, our sample is not dominated by any particular industry. Observations in each PMID group are distributed relatively evenly across industries.

### *5.2 Empirical findings*

In this section we first report summary statistics on acquirer and target firm characteristics for the whole sample and subsamples in which we are able to create PMID. Next, we examine the association between PMID and market leverage at the year of merger.

| | | | No. of obs. | Fraction of sample |
|---|---|---|---|---|
| *Panel A: distribution of PMID* | | | | |
| PMID < 2 | | | 122 | 29% |
| PMID = 2 | | | 155 | 36% |
| PMID > 2 | | | 143 | 34% |
| *Panel B: number of observation by merger type* | | | | |
| Horizontal merger | | | 223 | 53% |
| Vertical merger | | | 84 | 20% |
| Diversifying merger | | | 113 | 27% |
| *Panel C: number of observation by industry* | | | | |
| SIC | Industry title | PMID < 2 | PMID = 2 | PMID > 2 |
| 1 | Mining and construction | 6 | 5 | 4 |
| 2 | Manufacturing (food–petroleum) | 30 | 25 | 30 |
| 3 | Manufacturing (plastics–electronics) | 32 | 50 | 35 |
| 4 | Transportation and communication | 13 | 13 | 40 |
| 5 | Wholesale and retail trade | 14 | 32 | 19 |
| 6 | Services (hotels–recreation) | 21 | 7 | 13 |
| 7 | Services (health–private household) | 6 | 23 | 2 |

**Table III.** PMID distribution, number of observations by industry and PMID

Third, we examine the impact of PMID on the choice of method of payment. Fourth, we verify our results by examining the magnitude of the change in leverage around the merger that is attributable to PMID. Finally, we examine the leverage dynamics during the post-merger integration period.

*5.2.1 Acquirer and target firm characteristics*. Table IV provides median values for selected acquirer and target firm characteristics for the initial sample and subsamples across three PMID groups.

| | All deals | Equity payment | Cash or mixed | With PMID | Without PMID |
|---|---|---|---|---|---|
| *Panel A: median acquirer characteristics* | | | | | |
| CPI-adjusted market value of assets ($mm) | 436.23 | 315.17* | 549.81*** | 2,017.29*** | 3,517.27 |
| Market-to-book ratio | 1.87 | 2.51 | 1.62** | 1.71*** | 1.91 |
| Profitability | 0.14 | 0.20 | 0.14** | 0.19*** | 0.12 |
| Cash holding | 0.16 | 0.31 | 0.08*** | 0.07*** | 0.10* |
| Market leverage | 0.30 | 0.25 | 0.36*** | 0.27*** | 0.24 |
| Pre-merger leverage deviation | −0.11 | −0.14 | −0.08*** | −0.07*** | −0.14 |
| *Panel B: median target characteristics* | | | | | |
| CPI-adjusted market value of assets ($mm) | 198.27 | 149.16 | 226.01*** | 1,082.27*** | 132.26 |
| Relative size to acquirer | 0.59 | 0.55 | 0.44*** | 0.52** | 0.51 |
| Market leverage | 0.33 | 0.13 | 0.29*** | 0.30*** | 0.25 |
| *Panel C: median acquirer characteristics with different integration duration* | | | | | |
| Integration period | PMID < 2 | PMID = 2 | PMID > 2 | | |
| CPI-adjusted market value of assets ($mm) | 950.21 | 1,427.28*** | 5,012.62** | | |
| Market-to-book ratio | 1.29 | 1.71 | 1.91*** | | |
| Profitability | 0.15 | 0.14 | 0.16 | | |
| Cash holding | 0.08 | 0.07 | 0.06 | | |
| Market leverage | 0.31 | 0.31*** | 0.31 | | |
| Pre-merger leverage deviation | −0.11 | −0.07** | −0.07 | | |

**Notes:** *,**,***Significant at 10, 5 and 1 percent levels, respectively

**Table IV.** Acquirer and target characteristics

Panel A shows that the market value of acquirers paying with equity is smaller than that of acquirers paying with cash or paying with a mix of cash and equity. The higher ratios of market-to-book assets for acquirers paying with equity suggest that these acquirers have larger growth opportunities, consistent with the studies of Martin (2016) and Harford (2015). In addition, acquirers paying with equity tend to be less profitable and hold more cash. Furthermore, Panel A also shows that market leverage is much lower for equity deals. Given that acquirers paying with equity tend to have larger investment opportunities, it is likely that they hold larger cash balances and are less leveraged (i.e. Titman and Wessels, 2015). Panel A also indicates that the market value of acquirers for the PMID sample is larger than that of the sample of acquirers in which we are not able to construct PMID. This is not surprising as there is likely much more media/news coverage of larger firms. However, the market-to-book ratio of acquirers in which we can create PMID is slightly lower than that of acquirers in which we cannot construct PMID. Moreover, acquirers that have PMID are likely to be more profitable, hold less cash and have higher leverage. They are in general more similar to acquirers paying with cash or with mix of cash and equity. Panel A also reports acquirer firm leverage deviations. The pre-merger leverage deviation for all deals is negative; and more negative for stock acquirers. Firms in which we are able to create PMID are on average less underleveraged than firms in which we cannot create PMID. Specifically, the median leverage deviation is −0.06 and −0.14 for the PMID sample and non-PMID sample, respectively.

Panel B presents summary statistics regarding target firm characteristics. Particularly, market size and relative size of target to acquirer are both larger for deals in which we can construct PMID. Additionally, target market leverage is higher in deals in the PMID sample.

Panel C provides information about acquirer characteristics across different PMID groups. The median market value of acquirers' assets increases monotonically as PMID becomes longer. For example, the median market value of acquirers in PMID $< 2$ years group is approximately \$950m, while the median market value of acquirers in PMID $> 2$ years group is approximately \$5bn. In addition, the market-to-book ratio increases monotonically across PMID groups, but the differences are only marginally significant. Furthermore, Panel B shows that market leverage, defined as total book debt scaled by total market assets is 0.27 for the PMID $< 2$ years group, 0.39 for the PMID $= 2$ years group and 0.40 for the PMID $> 2$ years group. Moreover, the firms with shorter PMID tend to have a larger leverage deficit prior to the merger.

*5.2.2 Market leverage at the year of merger*. In this section, we examine whether PMID is a factor in determining the leverage behavior at the year of the merger. We follow the capital structure literature and regress firm leverage on PMID and a number of factors that have been documented to impact capital structure. It is again worth noting that since we are collecting our data and creating PMID from electronic financial filings as well as news searches on FACTIVA we are undoubtedly bound to have larger firms in our PMID sample as it is more likely that news coverage is of large established firms as opposed to smaller ones. In light of this, we study the impact of PMID on leverage determination by implementing a two-stage Heckman selection model to control for the propensity to find managements' statements of synergy description and thus our ability to create the PMID variable for larger firms and larger deals.

Table V reports the results of the two-stage Heckman selection model.

In the first stage, we estimate a probit model to explain whether acquirers report PMID or not. The dependent variable is a dummy variable set equal to 1 if the acquirer reports PMID, and 0 otherwise. Since acquirer managers tend to discuss PMID in news stories when the merger is announced, we include pre-announcement fiscal year-end acquirer size and market-to-book ratio in the regression. To control for the possibility that

| | Coefficient | | *z*-statistics |
|---|---|---|---|
| *First stage: probit model of acquirers reporting PMID* | | | |
| Vertical merger dummy | 0.152 | | 0.92 |
| Horizontal merger dummy | 0.185 | | 1.91 |
| Pre-announcement market-to-book ratio | 0.041 | | 1.14 |
| Pre-announcement CPI-adjusted acquirer sales | 0.377** | | 9.81 |
| Pre-announcement acquirer CAR | −0.169** | | 1.72 |
| Relative size of target to acquirer | 0.369*** | | 5.71 |
| 12-month change in economic indicators | −0.411 | | 0.79 |
| Target is a private firm dummy | −0.717** | | 4.75 |
| Target is a subsidiary dummy | −0.507*** | | 3.82 |
| Intercept | −2.917** | | 11.28 |
| Pseudo-$R^2$ | | 0.167 | |
| Number of observations | | 3,120 | |
| *Second stage: explaining the post-merger market leverage* | | | |
| Pre-merger VWML | 0.723** | | 7.19 |
| Post-merger integration duration (PMID) | −0.018*** | | 3.01 |
| Tangibility | −0.021 | | 0.14 |
| Market-to-book ratio | −0.503*** | | 4.12 |
| R&D | −0.162 | | 1.62 |
| Profitability | −0.481 | | 1.37 |
| Natural log of CPI-adjusted sales | 0.002 | | 0.24 |
| Dividend dummy | 0.053 | | 1.85 |
| Investment tax credit dummy | −0.172** | | 1.73 |
| Net operating loss carry forward dummy | −0.006 | | 0.20 |
| Inverse Mill's ratio | −0.058 | | 0.18 |
| Intercept | 0.417 | | 1.93 |
| $R^2$-adjusted | | 0.451 | |
| Number of observations | | 409 | |

**Notes:** *,**,***Significant at 10, 5 and 1 percent levels, respectively

**Table V.**
Explaining market leverage after merger completion

acquirers are more likely to discuss PMID when they conduct acquisitions of a larger target, we include the relative size of the target to the acquirer as an independent variable. We also create a "merger type" dummy variable to control for the likelihood that the propensity to report PMID is influenced by whether the proposed merger is horizontal, vertical or diversifying. Finally, we include pre-announcement acquirer abnormal return, change in the index of leading economic indicators, specifically the change in S&P 500 index or the change in Moody's BAA-rated bond yield during the 12 months prior to the month of merger announcement, public status of the target and announcement year dummies.

In the second stage, we use an OLS model to predict market leverage at the year of merger completion. The primary explanatory variable of interest in the regression is PMID and our hypothesis is suggests that market leverage will be negatively associated with PMID. To control for acquirer size, we include the natural logarithm of CPI-adjusted sales. Additionally, we also control for the level of pre-merger leverage level by including the acquirer and target value-weighted market leverage ratio at one year prior to the merger. We further control for the market-to-book ratio, profitability, tangibility, R&D, a dividend dummy variable set equal to 1 if the firm pays a cash dividend, and two dummy variables set equal to 1 if the firm has a net operating loss carry forward or investment tax credit. Except for the level of pre-merger leverage, all other variables in the regression are contemporaneous. Finally, we control for industry effects by including the firms' two-digit SIC code.

The result in Table V shows that PMID is significantly negatively associated with the leverage of the combined entity at the year of merger. Furthermore, the magnitude of the coefficient on PMID indicates that this relation is not only statistically significant, but also economically significant. The coefficient on this variable suggest that if the post-merger integration is expected to take one additional year to complete, the market leverage at merger completion is reduced by approximately 2.92 percent. The results in Table V also show a significant relation between leverage and other relevant control variables. As expected, a significant positive relation exists between the pre-merger acquirer-target value-weighted market leverage and the leverage at the year of merger completion.

*5.2.3 Fraction mergers paid for with equity*. Table VI presents the results of a two-sided Tobit model to explain the fraction of the deal paid for with equity. The dependent variable in the Tobit model is truncated at 0 and 1. To control for the probability that we are able to find merger-related news articles (managerial statements) to construct PMID for certain deals as opposed to others, we also include the inverse Mill's ratio estimated from the previous probit model in the regression as a regressor. Our intuition suggests that the fraction of a deal paid for with equity should be positively related to PMID. That is to say, the leverage of the newly merged firm will be lower if acquirers use more equity and less cash (debt) to finance a deal.

To control for acquirer size we include the natural logarithm of CPI-adjusted sales (in 1999 dollars). Additional control variables include the pre-merger market value-weighted acquirer and target market leverage and pre-merger market leverage deviation. Following Martin (2016), we control for market timing on the part of acquirer management (i.e. acquirer management using overvalued shares as currency in order to purchase the target) by including the market-adjusted 12-month pre-merger acquirer stock return. Specifically, we control for the change in the Standard & Poor's 500 index or the change in the yield on Moody's BAA-rated bonds. In addition, we include the relative size of the target to the bidder since the larger size of the target could increase the bidder's likelihood to pay for the target with equity. Furthermore, we control for the public status of the target as this could influence the method of payment because of more information asymmetry regarding the valuation of private or subsidiary targets as these targets face a higher "liquidity discount" on the M&A market (i.e. Berkovitch and Narayanan, 2010). Finally, we also include acquirers' pre-merger cash balance in the regression.

**Table VI.** Explaining the fraction of the deal paid for with equity

| | Whole sample | PMID sample |
|---|---|---|
| Post-merger integration duration (PMID) | | 0.132*** (3.16) |
| Pre-merger VWML | −1.151*** (3.81) | 0.128 (0.23) |
| Pre-merger leverage deviation | 0.806*** (3.19) | 0.718 (1.24) |
| Market-to-book ratio | | 0.041 (0.77) |
| Pre-announcement acquirer CAR | 0.307*** (6.05) | 0.203 (1.13) |
| 12-month change in economic indicators | 0.114 (0.51) | −0.527 (0.92) |
| Natural log of CPI-adjusted sales | −0.072*** (3.00) | 0.147** (1.92) |
| Relative size of target to acquirer | 0.316*** (5.05) | 0.603*** (2.92) |
| Cash/book asset | 0.817*** (5.35) | 0.902** (2.03) |
| Target is a private firm dummy | −0.602*** (7.17) | −0.911*** (2.96) |
| Target is a subsidiary dummy | −0.512*** (4.12) | −0.823*** (3.04) |
| Inverse Mill's ratio | | 4.025** (3.01) |
| Intercept | 1.328*** (7.01) | −3.417*** (3.03) |
| Pseudo-$R^2$ | 0.091 | 0.081 |
| Number of observations | 3,000 | 395 |

**Notes:** *,**,***Significant at 10, 5 and 1 percent levels, respectively

We implement our analysis on our initial sample and our PMID sample. The coefficient of pre-merger year leverage deviation is positively and significantly associated with the fraction of the deal paid for with equity. However, this variable loses statistical power in our PMID sample. Consistent with our intuition, the results from show a positive association between PMID and the fraction of the merger paid for with equity. This is consistent with our hypothesis that acquirer managers are less likely to conduct leverage increasing financing of the merger if they expect post-merger integration takes time to complete.

*5.2.4 Change in market leverage resulting from mergers*. Our previous results demonstrate a negative relation between market leverage after the merger completion and PMID, and also a positive relation between PMID and the fraction of the deal paid for with equity. In this section, we further assure our results by analyzing the change in market leverage around the year of merger.

Table VII presents results of regressions that explain the change in leverage from year $t-1$ to year t (i.e. one year before merger to the year of the merger). Other than the variables included in the regression of Table VI, we also include the change in optimal leverage in each specification. To show that PMID has additional power in explaining the leverage change before and after a merger, we include the merger-induced change leverage in the regression. In line with our hypothesis, we expect a negative relation between PMID and the actual change in market leverage from year $t-1$ to year $t$.

*5.2.5 Leverage dynamics during the post-merger integration period*. We define the remaining PMID (RPMID) as PMID minus the number of years elapsed after a merger; therefore, RPMID ranges from 0 to initial PMID. We apply a firm fixed effects model to analyze the extent to which our PMID and RPMID variables affect the leverage dynamics during the integration period, controlling for a number of conventional variables.

Table VIII reports the regression results. As expected, market leverage is negatively and significantly associated with our PMID and RPMID variables. The magnitude of the coefficients implies that the relationship is not only statistically significant, but also economically significant. A one year increase in PMID leads to about a 6.9 percent decrease in a firm's leverage during the integration period, and a one year increase of the RPMID results in about a 2.5 percent decrease in a firm's market leverage during that period.

| | Whole sample (1) | PMID sample (2) | PMID sample (3) |
|---|---|---|---|
| Post-merger integration duration (PMID) | | −0.030*** (2.32) | −0.019** (2.03) |
| Pre-merger VWML | −0.621 (1.13) | −0.315*** (3.92) | −0.126 (1.13) |
| Pre-merger leverage deviation | −0.281** (3.15) | | −0.314*** (2.15) |
| Merger-induced change in target market leverage | 0.601*** (11.28) | | 0.518*** (4.01) |
| Market-to-book ratio | | −0.015** (2.01) | −0.024** (1.81) |
| Pre-announcement acquirer CAR | −0.034*** (5.21) | 0.002 (0.05) | −0.012 (0.41) |
| 12-month change in economic indicators | 0.027 (0.61) | 0.131 (1.72) | 0.071 (0.91) |
| Natural log of CPI-adjusted sales | 0.003 (0.56) | −0.015 (1.19) | −0.006 (0.44) |
| Relative size of target to acquirer | 0.007 (0.79) | −0.021 (1.18) | −0.006 (0.51) |
| Cash/book asset | −0.162*** (6.17) | −0.401 (0.46) | −0.081 (1.14) |
| Target is a private firm dummy | 0.041*** (2.67) | 0.130*** (2.40) | 0.145** (2.37) |
| Target is a subsidiary dummy | 0.068** (3.05) | 0.145*** (2.23) | 0.119** (1.80) |
| Inverse Mill's ratio | | −0.501*** (2.13) | −0.315* (0.82) |
| Intercept | −0.062* (2.17) | 0.610*** (2.19) | 0.410 (1.27) |
| $R^2$ | 0.209 | 0.181 | 0.271 |
| Number of observations | 2,505 | 272 | 240 |

**Notes:** *,**,***Significant at 10, 5 and 1 percent levels, respectively

**Table VII.** Explaining the change in market leverage around the merger

| | (1) | (2) |
|---|---|---|
| Post-merger integration duration (PMID) | −0.081*** (3.03) | |
| Remaining integration duration (PMID) | | −0.032*** (3.00) |
| Tangibility | 0.713*** (4.05) | 0.692*** (3.12) |
| Market-to-book ratio | −0.013 (0.37) | −0.012 (0.60) |
| R&D | −0.020 (0.07) | −0.051* (0.49) |
| Profitability | −0.717*** (2.35) | −0.512 (0.20) |
| Natural log of CPI-adjusted sales | 0.031 (0.91) | −0.713*** (2.43) |
| Dividend dummy | −0.042 (1.08) | −0.040 (1.14) |
| Investment tax credit dummy | −0.034* (0.51) | −0.034 (0.62) |
| Net operating loss carry forward dummy | 0.061** (1.82) | 0.050** (1.81) |
| Intercept | 0.092 (0.41) | 0.061* (0.36) |
| $R^2$-adjusted | 0.901 | 0.917 |
| Number of observations | 855 | 855 |

**Notes:** *,**,***Significant at 10, 5 and 1 percent levels, respectively

**Table VIII.** Explaining the leverage behavior during the post-merger integration period

Therefore, the evidence in this section supports our hypothesis that merged firms tend to maintain a higher degree of financial flexibility by keeping a lower level of leverage during the integration process if merger-related synergies take more time to materialize.

*5.2.6 Robustness of the results*. Our results remain quantitatively similar if we include year dummies or if we use three-digit SIC code industries or if the PMID is 1 or 3 years. We also implement the study on our PMID sample without the Heckman two-stage specification. The coefficient estimation of PMID is also statistically and economically significant. We construct the fraction of the deal paid for with equity using SDC deal transaction reports. Furthermore, our results are similar if we include pre-merger market leverage of the acquirer instead of weighted average leverage of the acquirer and the target.

## 6. Conclusion

This paper provides a model and empirical evidence that the leverage behavior around mergers and during the post-merger integration period is affected by the acquirer's expectation about the length of the PMID. The model offers new implications as well as economically plausible explanations to several stylized facts about the observed capital structures of mergers. The model substantiates the argument that due to anticipated delays in capturing merger-related gains, an acquiring firm should rationally preposition itself by choosing lower leverage immediately before initiating the merger and should keep a lower degree of leverage during the post-merger integration period.

Empirical tests support the model implications by showing that the longer the expected post-merger integration process, the less likely the acquirer will structure the financing of the combined firm in a manner that increases firm leverage. Since integration takes time to complete, an acquirer tends to retain financial flexibility during the integration process by assuming lower levels of debt when determining the capital structure of the merged entity. We document that the market leverage of a newly merged firm is negatively associated with the length of the integration period. Our results also suggest that, other things being equal, acquires are more likely to finance the deal with equity when they expect a longer integration period. Finally, we show that the duration of the integration period can help explain leverage dynamics during the post-merger integration period. Overall, the model indicates that the PMID is negatively associated with the market leverage of newly merged firms at the time of merger completion and during the integration period. Further, acquirer managers are more likely to use equity to finance a merger when the integration duration is likely to be lengthy.

## Notes

1. We only select deals in which SDC code as "Mergers" in the "form of deal" item.
2. This condition is introduced because integration period is likely to have a material impact on the capital structure of a newly merged firm only if the acquirer and the target are of a comparable size.

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