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M&A Activity and the Capital Structure of Target Firms

Mark J. Flannery
University of Florida Warrington School of Business
flannery@.ufl.edu (corresponding author)

Jan Hanousek
Charles University and the Academy of Sciences CERGE-EI, Mendel University, and CEPR
jan.hanousek@cerge-ei.cz

Anastasiya Shamshur
King's College London King's Business School and Charles University and the Academy of Sciences CERGE-EI
anastasiya.shamshur@kcl.ac.uk

Jiri Tresl
University of Mannheim Business School and Charles University and the Academy of Sciences CERGE-EI
jtresl@mail.uni-mannheim.de

Abstract

We study 6,083 European firms that were acquired between 1999 and 2015. Soon after the acquisition, the acquired firms promptly and substantially close the gap between their actual leverage ratios and their target (optimal) ratios. Firms that were over- (under-) leveraged at the start of their acquisition year move their debt-to-assets ratio from 34.1% to 20% (10% to 18.5%) by the end of the following year. Under-leveraged firms expand their assets rapidly following acquisition, as they gain improved access to investable resources. Our results are consistent with the trade-off theory of capital structure and with the existence of firm-specific target leverage ratios.

I. Introduction

The finance literature includes a long-standing debate about how firms choose their capital structures. The debate poses two main questions. First, do firms prefer a specific leverage ratio? Second, if they do, why do not they always stay close to that ratio? The trade-off theory of capital structure asserts that firms choose an optimal leverage ratio that balances the effects of tax savings against potentially distorted investment incentives, executive compensation, and bankruptcy costs. Korteweg (2010) and Van Binsbergen, Graham, and Yang (2010) calculate that deviating from a firm's target leverage ratio impairs its value, particularly for over-leveraged firms. Why, then, do firms maintain leverage ratios (especially excessively high ratios) far

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from their targets? Fischer, Heinkel, and Zechner (1989) suggest that transaction costs can rationally limit a firm's convergence toward its target leverage[1] (see also Leary and Roberts (2005)). In line with this transaction costs argument, Faulkender, Flannery, Hankins, and Smith (2012) conclude that firms with free cash flows adjust their leverage with relatively low costs. Their empirical work indicates that such firms adjust their leverage considerably faster than the average firm, especially if they are over-leveraged.

A sudden drop in a firm's adjustment costs should cause it to move relatively quickly toward its target value. Such a cost shock would provide an ideal venue for testing the trade-off hypothesis. Merger transactions may provide such a shock. We assemble a sample of target European firms that closely resembles that of Erel, Jang, and Weisbach (2015), who conclude that small European firms' financial constraints are substantially loosened when they are acquired. If firms have leverage targets, we should observe substantial convergence toward those targets when a firm is acquired.

The connection between leverage and acquisitions has been studied previously, using samples of relatively large, publicly traded U.S. acquirers. Harford, Klasa, and Walcott (2009), Uysal (2011), and Vermaelen and Xu (2014) all examine how an *acquiring* firm's capital structure affects the acquisition's payment medium (cash vs. shares). Harford et al. (2009) show that highly levered acquirers are less likely to offer cash payments in a merger. Cash offers are generally financed with new debt issuance, which tends to be unacceptable to a firm that is already highly leveraged. Harford et al. (2009) document that firms whose leverage exceeds (lies below) their leverage target are more likely to pay for an acquisition with shares (cash). They also show that cash-financed acquisitions are associated with leverage increases that are largely reversed after the merger, consistent with the hypothesis that acquiring firms have some sort of leverage target. Vermaelen and Xu (2014) also show that an acquirer's capital structure affects its choice of payment medium. Target firms are reluctant to accept shares because of the lemons problem: a firm offering to pay with its shares is likely to consider those shares over-valued. The acquirer must therefore offer a reason for paying with shares and high leverage can be used to justify share payments, at least partly counteracting the lemons problem. As a result, Vermaelen and Xu (2014) find that highly leveraged firms are more likely to offer shares as payment to the acquired firm. Uysal (2011) goes beyond the analysis in Harford et al. (2009) and Vermaelen and Xu (2014) to investigate whether leverage affects the probability of making an acquisition. He reports that over-leveraged firms are less likely to acquire another firm. Consistent with this, he also finds that acquisition-minded firms tend to reduce their debt-equity ratios in anticipation of a merger deal, thereby freeing themselves up to pay with (borrowed) cash. These three papers take a dynamic view of firm leverage choice: firms have target leverage ratios but move only slowly toward their targets on account of adjustment costs.

Many empirical estimates of "partial adjustment" leverage models provide some support for the trade-off theory, although the estimated adjustment speeds

[1]Another possibility is that the typical firm's value function is not very sensitive to leverage, so firm transaction costs discourage rapid convergence to any target they may have.

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are sometimes viewed as "too slow" for an important influence on firm value. Can leverage targets be very important, it is asked, if the typical firm moves so slowly toward them (Baker and Wurgler (2002), Fama and French (2002), Welch (2004), and Iliev and Welch (2010))? By studying leverage changes associated with being acquired, we focus on a sample of firms whose financial frictions may have been suddenly reduced. According to Fischer et al. (1989), reducing financial constraints should hasten the speed with which firms move toward their leverage targets. Our methodology thus avoids an important criticism of leverage studies that report significant, but arguably slow, adjustment speeds toward target leverage.

Our main purpose in this article is to investigate, for the first time, whether a firm's acquisition affects its observed capital structure. Rapid post-acquisition leverage adjustments would reflect both the existence of leverage targets and the relaxation of financial constraints when a firm is acquired. The absence of previous studies investigating the impact of an acquisition on target firms' capital structure probably reflects the limited public availability of information about target firms' financial accounts after the acquisition. In the U.S., public firms generally report only consolidated financial statements at the parent level and detailed information about private firms' capital structures is difficult to obtain, either before or after the acquisition event. We, therefore, focus on data from European countries, where all companies (even subsidiaries) are required to report financial information on a regular basis.

Our data set includes 6,083 European target firms acquired during the period 1999–2015. Using a similar data set, Erel et al. (2015) report that acquired firms exhibit relaxed financial constraints following acquisition: they hold less cash, their cash-holding and investments become less sensitive to cash flow, and their investments rise. The authors (p. 324) argue that "These results are consistent with the view that financial constraints are reduced for target firms when they are acquired." They presume that "the parent's cash flows and access to capital markets allow the target firm to manage its financial position more efficiently." (p. 290). Although Erel et al. (2015) do not consider leverage changes following an acquisition, their conclusions about financial constraints make this an ideal place to examine whether relieving financial constraints leads firms to move toward target leverage ratios.[2]

We begin by exploring a related question to that studied by Uysal (2011): whether a firm's deviation from its leverage target affects its probability of *being acquired.* If leverage deviations affect firm value, as in Korteweg (2010) and Van Binsbergen et al. (2010), mis-leveraged firms may pose more tempting acquisition targets for acquirers with the resources to correct the target's leverage-based misvaluation. We therefore test:

Hypothesis 1. Mis-leveraged (and therefore under-valued) potential targets are no more likely to be acquired than optimally leveraged firms.

[2]The partial adjustment theory of leverage implies that a firm's optimal leverage adjustment depends (roughly) on how far it is from its target leverage and how much it costs to move closer to that target. Most of our exposition assumes that the primary effect on acquired firms' leverage results from reduced adjustment costs. However, an acquired firm might also have a different target leverage ratio following its acquisition. Post-acquisition leverage adjustments might occur if the new targets are systematically further away from their pre-acquisition target values. We discuss this possibility in Section V.

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We estimate a target leverage ratio for each potential target firm and compute its deviation from that estimated target. We then divide acquired firms into 3 groups: "over-leveraged" firms whose pre-merger deviation from target exceeds +1% of assets, "under-leveraged" firms whose deviations fall below −1% of assets, and "optimized" firms whose deviations from target leverage lie within 1% of assets.[3] We find that both positive and negative deviations increase the probability of being acquired. The effect is stronger for over-leveraged firms, whose probability of becoming a target stands about 5.6% ($p < 0.01$) above that of the "optimized" firms. Under-leveraged firms' acquisition probability increases slightly, but significantly, less (4.0%, $p < 0.01$).

We conjecture that the reduced financial frictions identified by Erel et al. (2015) may permit an acquired firm to move discretely toward its target leverage rate once it has access to its parent's internal capital markets.[4] Our paper's main hypothesis is, therefore:

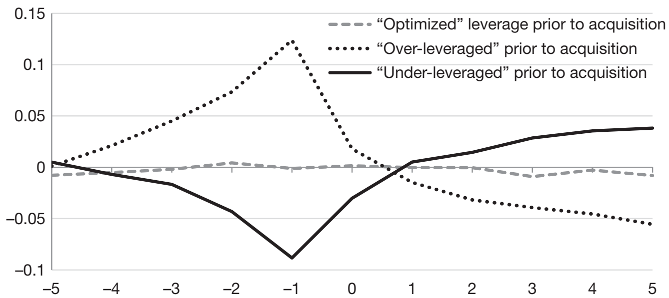
Hypothesis 2. Newly acquired firms do not adjust unusually quickly toward their target leverage ratios.

We reject this hypothesis: The typical acquired firm quickly and substantially moves toward its target leverage, consistent with the notion that the acquisition has reduced leverage adjustment costs. Figure 1 indicates that both over-leveraged and

FIGURE 1

Deviation from the Optimal Leverage

Figure 1 shows the evolution of the mean deviation from the optimal leverage (LEVDEV) from years −5 to +5 around an acquisition event for three sets of firms based on their deviation from target leverage at $t = -1$. "Optimized" firms are at their leverage targets prior to acquisition. "Under-leveraged" and "Over-leveraged" firms are at least 1% away from their target leverage ratios in the year prior to acquisition.



[3]Strebulaev and Yang (2013) evaluate the "puzzle" of zero-leverage firms, which constitute 10.2% of nonfinancial firms in the CRSP-Compustat universe and 23% of our acquired firms. When we omit zero-leverage firms from the sample the estimated coefficients do not substantially change (Table IA-VIII of the Supplementary Material).

[4]The (rather scarce) existing literature on subsidiaries' capital structure offers mixed conclusions about adjustment speeds. Kim, Heshmati, and Aoun (2006) find that Korean group firms adjust their capital structure faster than stand-alone firms. Similar results are reported for private Belgian firms by Dewaelheyns and Van Hulle (2012). However, Ghose (2017) and Ghose and Kabra (2017) report that Indian group firms adjust more slowly than their stand-alone counterparts.

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under-leveraged firms substantially move toward their optimal debt ratios between 1 and 2 years after being acquired. Regression models confirm this finding.

In exploring firms' speeds of leverage adjustment, DeAngelo, DeAngelo, and Whited (2011), Faulkender et al. (2012), and others find that over-leveraged firms adjust more quickly. We, therefore, test whether a firm's extent of convergence to its leverage target depends on whether the subsidiary was previously over- or under-leveraged:

Hypothesis 3. Over-leveraged and under-leveraged firms adjust toward their optimal leverage ratios equally quickly after being acquired.

We reject this hypothesis. Over-leveraged firms seem to close most of their deviation from target ratios by year 3, while under-leveraged firms take a little longer. Within the acquisition year, a previously over-leveraged (under-leveraged) target firm closes its leverage deviation by 6.7 (4.9) percentage points, which represents a reduction of 60.5% (65.3%).

Taken all together, we provide strong evidence that European firms have target leverage ratios and that deviations from these targets at least partially reflect transaction costs (financial frictions). The article proceeds as follows: Section II describes our data sources and provides sample summary statistics. Section III explains the target estimation method. Section IV discusses methodology and results. Section V examines the potential effects of acquisition on an acquired firm's target leverage and Section VI reports a set of robustness checks related to sample choice and regression specifications. Section VII concludes.

II. European Mergers: Data

We study annual balance sheet data from Amadeus for public and private European firms that were acquired between 1999 and 2015. Amadeus is a commercial database that provides information on more than 20 million companies across 34 Western and Eastern European countries. It reports the most recent 10 years of financial data for active and dead firms. Unfortunately, firms are dropped from the database 4 years after their last filing. We collected historical data from old Amadeus publications in order to eliminate survivorship bias and to record historical values of such firm-level information as company type and ownership information.

Data on M&A transactions come from the Zephyr database, which covers deals worldwide, and European deals from 1997 onward. Zephyr and Amadeus provide a common identifier to ensure accurate matching of firms between data sets.[5] We consider only European M&A deals because we need the acquired firms' financial accounts after the acquisition. As in Netter, Stegemoller, and Wintoki (2011) and Erel et al. (2015), about 90% of our target firms are privately owned.

The Zephyr database describes M&A deals involving European target firms in 22 countries over the period from 1999 to 2015. Panel A of Table 1 describes our

[5]Erel et al. (2015) also provide a good description of the available data, which has also been used by Klapper, Laeven, and Rajan (2006), Bena and Ortiz-Molina (2013), and Frésard, Hege, and Phillips (2017).

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TABLE 1

Descriptive Statistics

Table 1 describes our data about acquired European firms from the years 1999–2015. Panel A explains how we constructed the sample of European targets from the Zephyr database, requiring that each included firm provided financial data in Amadeus for at least 1 year before and after the acquisition. The target firms' financial data exist for up to 11 years, from 5 years before the acquisition to 5 years after. The average sample firm has 7.8 years of financial data. Panels B and C indicate the distribution of these acquired firms across industries and countries respectively. Panel D provides summary statistics for the main variables used in the econometric analysis. Variable definitions are provided in the Appendix. Panel D treats all observations equally, although firms differ in the duration of their data availability within the [−5, +5] interval.

Panel A. Sample Construction

		Deal Value (Mil. USD)		
Step Description	No. of Firms	Mean	Median	# Deals
All deals in Zephyr with the target in 1 of 22 European countries between 1999 and 2015 with a nonmissing deal completion date and target id	114,681	224.6	12.8	35,200
All deals which acquired majority (50%+)	93,929	240.2	14.4	27,471
All deals where target can be matched to Amadeus data	18,290	284.6	18.6	5,209
Excluding acquired agriculture, utilities, financial firms, insurance, and public sector firms	17,231	287.8	18.1	4,899
At least 1 year of data before and after the acquisition 2002	6,083	291.2	26.4	2,108

Panel B. Number of Acquisitions, by Industry (As Per Section of NACE Rev 2)

Target Industry	*N*	%
Accommodation and food service activities	125	2.05
Activities of extraterritorial organizations and bodies	3	0.05
Administrative and support service activities	290	4.77
Arts, entertainment and recreation	58	0.95
Construction	346	5.69
Information and communication	619	10.18
Manufacturing	2,190	36.00
Other service activities	39	0.64
Professional, scientific and technical activities	682	11.21
Real estate activities	328	5.39
Transportation and storage	314	5.16
Water supply; sewerage, waste management, and remediation activities	50	0.82
Wholesale and retail trade; repair of motor vehicles and motorcycles	1,039	17.08
Total	6,083	100.00

Panel C. Acquisitions Characteristics, by Country of Target

Target Country	No. of Deals	Domestic Deals (%)	Independent Target (%)	Private Target (%)	Public Acquirer (%)
Austria	49	34.69	69.39	97.96	30.61
Belgium	468	44.44	69.02	92.31	19.23
Bulgaria	535	71.59	91.03	92.52	3.74
Croatia	48	47.92	72.92	85.42	33.33
Czech Republic	259	36.68	72.97	92.66	14.67
Estonia	85	50.59	63.53	85.88	8.24
Finland	306	67.65	75.49	96.73	10.78
France	1,121	67.53	68.69	89.56	21.50
Germany	283	42.05	71.02	93.29	26.50
Greece	37	48.65	70.27	67.57	40.54
Hungary	54	40.74	75.93	98.15	16.67
Ireland	9	33.33	88.89	88.89	11.11
Italy	622	54.98	69.13	91.00	25.08
Latvia	97	43.30	71.13	91.75	10.31
Lithuania	21	42.86	85.71	61.90	23.81
Netherlands	20	60.00	95.00	10.00	15.00
Poland	202	56.93	65.35	94.55	34.65
Portugal	92	56.52	70.65	83.70	18.48
Slovak Republic	55	36.36	81.82	78.18	25.45
Spain	568	61.27	66.73	92.78	14.79
Sweden	738	62.60	73.31	94.85	23.58
United Kingdom	414	53.14	78.99	79.71	25.60
Average	[Total = 6, 083]	57.82	72.73	90.70	19.71

(continued on next page)

TABLE 1 (continued)

Descriptive Statistics

Panel D. Acquired Firms' Summary Statistics

Variable	*N*	Mean	Std. Dev.	Distribution 5th	50th	95th
LEVERAGE	47,457	0.180	0.209	0.000	0.102	0.618
LEVDEV	47,457	0.0002	0.126	−0.187	−0.007	0.227
LEVDEV_OVER_LEVERAGED	20,086	0.014	0.134	−0.192	0.002	0.249
LEVDEV_UNDER_LEVERAGED	25,410	−0.011	0.123	−0.190	−0.016	0.210
ln (TOTAL_ASSETS)	47,457	16.51	2.034	13.19	16.49	19.92
GROWTH	44,763	1.111	0.693	0.537	1.035	1.722
CAPEX	42,799	0.052	0.121	−0.097	0.029	0.278
CASH	45,242	0.107	0.149	0.001	0.047	0.427
ROA	47,298	0.039	0.171	−0.201	0.040	0.269
TANGIBILITY	47,404	0.222	0.237	0.001	0.133	0.729
INTANGIBILITY	46,622	0.038	0.087	0.000	0.003	0.237
CASH_FLOW	43,011	0.065	0.147	−0.159	0.066	0.272
FIRM_AGE	31,664	23	18	5	18	57
PRIVATE_CREDIT/GDP	46,908	92.14	36.23	44.27	90.09	168.2
MARKET_CAP/GDP	42,989	64.65	33.35	14.02	65.79	121.8
GDP_Growth	47,457	1.346	2.904	−4.188	1.687	5.603

sample selection process. We started with 114,681 acquired firms. Of these, 93,929 deals resulted in the acquirer's stake exceeding 50% of voting shares, which should provide the acquirer with firm control over the target's subsequent actions. We could match 18,290 of these acquired firms to Amadeus financial information. We then excluded 1,059 firms in industries that are subject to specific government regulation: agriculture (NACE 2 01, 02, and 03), regulated utilities (NACE 2 35, 36), and financial and insurance firms (NACE 2 64, 65, and 66).[6] After requiring that our data set contains financial information at least 1 year before and 1 year after the acquisition year, the final data set consists of 47,457 annual observations on 6,083 acquired firms. More than 96% of sample firms were acquired only once during the sample period, which allows us to estimate a relatively clean acquisition effect on an acquired firm's capital structure. The rightmost 3 columns in Panel A of Table 1 describe the number of deals with complete value information and the mean/median of those deal values. The typical deal size rises somewhat as we narrow our sample.

Panel B of Table 1 reports the sample's industrial composition. The most common target industries are manufacturing (about one-third of the sample) and wholesale-retail trade (about one-sixth). Panel C presents the international distribution of acquired firms: about 18% of the transaction targets are French, 12% are Swedish, and 10% are Italian. The majority are domestic deals (58%), where the target is independent (73%) and private (91%).[7] Most of the acquirers are also private (fewer than 20% are public companies). Panel D reports descriptive statistics for the final sample of target firms, each of which can have up to 11 years' data. The mean availability for leverage data is 7.8 years and the sample firms' average

[6]NACE Rev. 2 groupings are analogous to SIC or NAIC codes in the United States. See https://ec.europa.eu/eurostat/web/nace-rev2 for details.

[7]We use Bureau van Dijk's (BvD) definition of an independent firm the BvD's variable "Independence Indicator" is equal to "A" (i.e., any company with known recorded shareholders *none* of which having more than 25% of direct or total ownership).

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debt is about 18% of total assets. An average firm is about 23 years old, with an 11.1% annual sales growth, and capital expenditures equal to 5.2% of assets.

III. Estimating Leverage Targets

Estimated leverage targets have a central role in our analysis. We utilize one set of estimated targets in most of our regressions, but we also show that our main results continue to hold under other plausible target constructions.

We define a firm's leverage as the ratio of short-term debt plus long-term debt to total assets. We must measure leverage using book values because most (91%) target firms are privately owned and therefore report no market value for their equity.[8] We estimate a firm's target leverage ratio as its fitted value from a regression that models the leverage ratio as a function of explanatory variables used in previous capital structure studies:

$$L_{i,t} = \beta X_{i,t-1} + \theta_i + \tau_t + \varepsilon_{i,t}, \tag{1}$$

where $L_{i,t}$ is firm i's book debt ratio at time t, $X_{i,t-1}$ is a vector of four firm-specific characteristics identified in Rajan and Zingales (1995) as major determinants of firms' leverage ratios: firm size, asset tangibility, growth, and profitability. Variable definitions are provided in the Appendix. θ_i is a set of firm effects, and τ_t is a set of year fixed effects.

Larger firms and those with more tangible assets may find it easier to borrow and therefore would tend to have higher leverage. Firms with higher profits may have higher retained earnings and hence lower leverage.[9] Faster-growing firms, ceteris paribus, may need to raise more external capital in the form of either debt or equity. We employ a fixed-effects model to control for firm-specific unobserved heterogeneity, which explains a large portion of the cross-sectional variation in leverage ratios (Flannery and Rangan (2006), Lemmon, Roberts, and Zender (2008)). Year fixed effects control for time-varying macroeconomic conditions over the sample period.

Our acquired firms come from 22 countries, which may differ substantially in their tax laws or bankruptcy codes. We, therefore, estimate a separate regression (1) for each country, using the entire universe of Amadeus firms available in that country. These country-specific regression estimates are reported in Table IA-I of the Supplementary Material. We calculate target leverage for each of our acquired firms as its fitted value using the estimated coefficients from (1). Table IA-II of the Supplementary Material reports average predicted target leverage ratios, which vary substantially within and across countries. The lowest average target leverages are observed in Hungary (0.033), Slovak Republic (0.066), and Bulgaria (0.078); the highest are observed in Ireland (0.314), Spain (0.311), and Portugal (0.303).

[8]Previous studies suggest that reliance on the book values is not a serious limitation (e.g., Rajan and Zingales (1995), Leary and Roberts (2005), and Faulkender et al. (2012)).

[9]This effect may be mechanical (Hovakimian et al., 2001), or it may reflect a decision to protect future profits by maintaining low leverage. We return to this question briefly in discussing Table 4.

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We also calculate a firm's leverage deviation ("LEVDEV$_{i,t}$") as its actual leverage minus its fitted target in the same year. By construction, the leverage deviations average nearly 0 in all countries, although their intra-country ranges (Max value minus Min) are generally quite substantial. We define three groups of acquired firms based on their LEVDEV[10]:

- A dummy variable OVER_LEVERAGED equals unity if LEVDEV (i.e., actual leverage less computed target leverage) > +1% of total assets in the year prior to the acquisition.
- A dummy variable UNDER_LEVERAGED equals unity if LEVDEV < −1% of total assets in the year prior to the acquisition.
- A dummy variable OPTIMIZED equals unity if the firm's actual leverage lies within ±1% of its target in the year prior to the acquisition.

A reduction in financial constraints (leverage adjustment costs) should lead over-leveraged (under-leveraged) firms to reduce (increase) their leverage. An optimized firm's leverage should be unaffected by a reduction in its financial constraints. We concede that our estimated leverage targets may be noisy, which should tend to weaken our statistical tests. Suppose, for example, that sample firms have no target leverage. (That is, the concept is entirely unsupported in the data.) Our tests should not indicate that actual leverage is converging to the computed targets. As part of our robustness analysis, we confirm that our major test results are unchanged when we use two alternative ways of estimating target leverage.[11]

IV. Empirical Results

Our main goal is to evaluate the impact of an acquisition on the firm's subsequent leverage changes. First, however, we explore the impact of mis-leveraging on the probability that a firm is acquired.

A. The Effect of Leverage on the Probability of Being Acquired

A firm's leverage could affect its attractiveness as a takeover target for several reasons. First, if a firm's leverage prominently influences its value, an acquiring firm could raise a target firm's value by quickly reducing its | LEVDEV |. Second, Stulz (1988) offers two reasons why high firm leverage per se might discourage its acquisition. High leverage reduces the target's ability to issue additional debt, which might be of interest to an acquirer. High leverage might also leave the firm exposed to debt covenants that restrain the acquirer's ability to manage target assets. In short, higher absolute deviations from target leverage may encourage acquisition while higher leverage itself may discourage it.

[10]Most of our reported results are based on a definition of "optimized" leverage being within 1% of its target value and mis-leveraged firms outside of these bounds. We confirmed that our main results are unaffected by broadening the bandwidth to 3% or 5% (Compare Table IA-III in the Supplementary Material to Table 4).

[11]One alternative estimates a dynamic model of leverage (regression (10) below) in place of the static specification (1). The other alternative permits acquired firms' leverage targets to change after they have been acquired, as in regression (7).

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To assess how leverage affects the probability of being acquired (Hypothesis 1), we augment our sample of acquired firms with a set of matched firms that were neither acquirers nor targets over our entire sample period (1999–2015). Following Bena and Li (2014), we identify up to five matched firms for each acquired firm by randomly selecting firms that operated in the same country and industry (based on 2-digit NACE Rev. 2 grouping) in the year preceding the transaction, and had total assets within 10% of the targets. This matching process creates a group of potential acquisition targets that captures M&A clustering in time (Mitchell and Mulherin (1996), Maksimovic, Phillips, and Yang (2013)) and by industry (Andrade, Mitchell, and Stafford (2001), Harford (2005)). We can identify at least one matching firm for 4,770 (out of 6,083) target firms in our sample.[12] The average matched target firm has approximately 4.5 matching firms, for a total sample size of 21,472 firm-years. The raw probability of being acquired in our matched sample is 22.2%. Descriptive statistics for the target firms and their matches are reported in Panel A of Table 2. Although the means and medians of many of the matched firms' characteristics differ significantly from those of the acquired firms, most of those differences are not large in economic terms.[13]

We now estimate a logit regression using a cross-section of data from the pre-acquisition year for acquired and matching firms:

$$(2)\quad P\left(\text{ACQUIRED}_{i,m,t}=1\right)=\alpha+\beta L_{i,m,t-1}+\gamma X_{i,m,t-1}+\vartheta_c+\mu_j+\tau_t+\left(\mu_j\times\tau_t\right)+\varepsilon_{i,m,t},$$

where $\text{ACQUIRED}_{i,m,t}$ equals unity if firm i is acquired in deal m and 0 otherwise. For each deal (m), there is one target firm and one or more matched firms. $L_{i,m,t-1}$ represents alternative measures of firm i's leverage at time $t-1$ in Table 2: in column 1 of Panel B, the firm's leverage ratio; in column 2 of Panel B, the firm's $|\text{LEVDEV}_{i,t-1}|$; in column 3 of Panel B, a pair of dummy variables indicating that the firm is over-leveraged or under-leveraged; in column 4 of Panel B, a pair of dummy variables indicating firms in the highest or lowest leverage tercile. $X_{i,m,t-1}$ is a set of firm-level characteristics measured at the end of the pre-acquisition year: log of total assets, growth, ROA, the proportion of intangible assets, cash holdings, cash flow, and industry median leverage. ϑ_c is a fixed effect identifying the acquired firm's country of residence. μ_j and τ_t are industry and year-fixed effects. Estimation results for regression (2) are reported in Panel B, where the reported numbers indicate the effect of a unit change in the explanatory variable on the probability of being acquired, holding the other covariates unchanged.

The first column of Panel B of Table 2 indicates that more highly leveraged firms are significantly less likely to be acquired, consistent with Stulz (1988). To assess the economic magnitude of this coefficient, recall that the sample-wide mean acquisition probability is 22.2%. The estimated coefficient on $\text{LEVERAGE}_{i,t-1}$ indicates that the probability of being acquired decreases by 1.6 percentage points as $\text{LEVERAGE}_{i,t-1}$ moves from the 25th (0.0002) to the (0.306) percentile of its

[12]We use the full set of 6,083 acquired firms in subsequent analyses that do not rely on matched, unacquired firms.

[13]With a large number of observations, even small differences can be statistically significant and differences should be judged in terms of their economic magnitudes (Lin, Lucas, and Shmueli (2013)).

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TABLE 2
Probability of Being Acquired

In Table 2, we selected up to five matching firms for each acquired firm. Matching firms were neither an acquirer nor a target over the sample period, operating in the same country and industry (based on a 2-digit NACE Rev. 2 grouping in year $t-1$), and had assets within 10% of the target's in year $t-1$. This methodology follows Bena and Li (2014). We could find suitable matching firms for only 4,770 of our 6,083 target firms, and the average matched target is associated with about 4.5 similar (unacquired) firms. Panel A displays the descriptive statistics for the end of year $t-1$ (the year before the acquisition), for the target firms with at least one matched firm, and the matches. Panel B presents results for the logit model estimated for the sample of the target and matched firms (equation (2)). The dependent variable takes the value of 1 if the firm was actually acquired and 0 otherwise. The reported coefficients represent the marginal effect of a unit change in the associated variable on the probability of being acquired. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level correspondingly. Variable definitions are provided in the Appendix.

Panel A. Descriptive Statistics for Targets and Their Matches in the Year Before Acquisition

	Target Firms (Treated)				Matched Firms (Control)					
Variables	Mean	Med	Std. Dev.	*N*	Mean	Med	Std. Dev.	*N*	Difference of Means	MW-Test Difference of Medians
LEVERAGE	0.179	0.104	0.207	5,260	0.188	0.100	0.224	22,165	−0.009***	1.51
LEVDEV	0.003	−0.004	0.127	5,260	−0.002	−0.004	0.101	22,165	0.005***	0.03
ln(TOTAL_ASSETS)	15.93	16.05	1.925	5,260	15.67	15.81	1.879	22,165	0.260***	55.15***
GROWTH	1.163	1.064	0.789	4,885	1.154	1.062	0.827	19,903	0.009	0.07
CAPEX	0.046	0.029	0.158	4,786	0.059	0.033	0.167	20,011	−0.013***	7.12***
CASH	0.126	0.057	0.167	5,126	0.132	0.050	0.190	21,326	−0.006**	10.88***
ROA	0.048	0.048	0.185	5,260	0.06	0.046	0.147	22,019	−0.012***	1.23
TANGIBILITY	0.221	0.13	0.24	5,260	0.252	0.152	0.269	22,144	−0.031***	22.32***
INTANGIBILITY	0.043	0.002	0.111	5,237	0.029	0.000	0.096	22,048	0.014***	329.70***
CASH_FLOW	0.07	0.075	0.192	4,778	0.083	0.069	0.170	19,952	−0.013***	9.97***
FIRM_AGE	20	16	17	3,498	20	16	16	15,053	0.000	3.94**

Panel B. Probability of Being Acquired (Estimation Results for Equation (2))

	Dependent Variable: Prob(Firm Is Acquired)			
	1	2	3	4
$LEVERAGE_{t-1}$	−0.051***			
	(0.015)			
$\vert LEVDEV_{t-1} \vert$		0.453***		0.500***
		(0.032)		(0.033)
$OVER\_LEVERAGED_{t-1}$			0.056***	
			(0.008)	
$UNDER\_LEVERAGED_{t-1}$			0.040***	
			(0.008)	
$TOP\_LEVERAGE\_TERCILE_{t-1}$				−0.048***
				(0.007)
$BOTTOM\_LEVERAGE\_TERCILE_{t-1}$				−0.015**
				(0.007)
$ln(TOTAL\_ASSETS)_{t-1}$	0.016***	0.015***	0.016***	0.015***
	(0.002)	(0.002)	(0.002)	(0.002)
$MEDIAN\_INDUSTRY\_LEVERAGE_{t-1}$	−0.071	−0.102*	−0.102*	−0.081
	(0.056)	(0.055)	(0.054)	(0.055)
$GROWTH_{t-1}$	0.002	0.001	0.002	0.001
	(0.004)	(0.004)	(0.004)	(0.004)
ROA_{t-1}	0.005	0.028	0.014	0.026
	(0.035)	(0.035)	(0.035)	(0.036)
$INTANGIBILITY_{t-1}$	0.209***	0.188***	0.199***	0.195***
	(0.025)	(0.026)	(0.025)	(0.026)
$CASH\_FLOW_{t-1}$	−0.089**	−0.077**	−0.086**	−0.085**
	(0.035)	(0.036)	(0.034)	(0.036)
$CASH_{t-1}$	0.024	0.058***	0.056***	0.047***
	(0.018)	(0.017)	(0.018)	(0.018)
Country FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry × Year FE	Yes	Yes	Yes	Yes
Pseudo-R^2	0.025	0.034	0.027	0.036
N	21,472	21,472	21,472	21,472

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sample distribution. The second column reports a significantly positive coefficient on the absolute value of leverage deviation ($|\text{LEVDEV}_{i,t-1}|$). This effect is larger than that of leverage itself. The mean firm's acquisition probability rises by 3.5% when $|\text{LEVDEV}_{i,t-1}|$ moves from its 25th to 75th percentile; it rises by a further 3.8% when $|\text{LEVDEV}_{i,t-1}|$ moves to its 90th percentile value. We conclude that the absolute deviation from optimal leverage has a larger effect than leverage itself on the probability of being acquired, consistent with the hypothesis that acquiring firms may be planning to increase the target's value by adjusting their leverage. The other explanatory variables in columns 1 and 2 carry coefficients that are consistent with the existing literature (e.g., Bena and Li (2014)).

Columns 3 and 4 of Table 2 establish the robustness of the leverage effects on acquisition probability. In column 3, $|\text{LEVDEV}_{i,t-1}|$ is replaced with dummy variables categorizing each firm as either over- or under-leveraged. (The omitted category of potential target firms has optimized leverage before the acquisition year.) These estimated coefficients indicate that over-leveraged (under-leveraged) firms are 5.6 (4.0) percentage points more likely to become targets than firms with $|\text{LEVDEV}| \leq 1\%$. A Wald test indicates that these two estimated coefficients differ significantly ($p < 0.01$). Column 4 examines the combined effect of leverage and $|\text{LEVDEV}_{i,t-1}|$ by adding to the specification in column 2 two dummy variables identifying firms in the lowest and highest leverage terciles.[14] The estimated effect of $|\text{LEVDEV}_{i,t-1}|$ remains roughly unchanged from column 2 when we add this information about the absolute leverage. The dummy variable coefficients indicate that firms with extreme leverage are significantly less likely to be acquired than those in the (omitted) middle leverage tercile. Excessively high leverage is more influential than low leverage: firms in the top leverage tercile are significantly ($p < 0.01$) less likely to be acquired than firms in the bottom leverage tercile. Overall, the results reject Hypothesis 1, that mis-leveraged firms are no more likely to be acquired.

The last 3 rows of Panel B of Table 2 indicate that variables reflecting financial constraints also influence the probability of being acquired. Greater asset intangibility increases the probability of being acquired, consistent with the idea that it is difficult for a firm to borrow against intangible assets (Barclay and Smith (2005)). Firms with higher cash flow are less likely to be acquired, perhaps because they need less external funding. Finally, acquired firms hold significantly more cash in three of the four specifications, consistent with constrained firms generally holding more cash to protect against unanticipated events.[15]

B. Leverage Changes: Difference Equation Results

If being acquired reduces financial frictions (leverage adjustment costs), target firms should move discretely toward their target leverage shortly after acquisition (Hypothesis 2). Figure 1 plots the mean leverage deviation (LEVDEV) for three groups of acquired firms over the 11-year period centered on the year of deal

[14]We do not include the leverage measure itself because it covaries quite substantially with $|\text{LEVDEV}|$, which includes the leverage measure as one of its components.

[15]Note that the coefficient on cash in column 1 is also positive, although insignificant. Erel et al. (2015) find a similar cash-holding result and offer a similar interpretation.

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completion ("year 0"). Optimized firms have no reason to change their leverage even if their financial frictions decline, and they do not. By contrast, mis-leveraged firms adjust their leverage quite aggressively soon after being acquired and smaller adjustments continue for the subsequent 5 years.

Table 3 presents a more detailed description of leverage paths before and after a firm is acquired. The leftmost 4 columns, which describe optimized firms, exhibit no substantial changes in their mean or median leverage over the entire period of analysis. The middle 4 columns indicate that over-leveraged target firms' leverage had been rising for 5 years preceding acquisition, ending year $t = -1$ at 34.4%. In the year following acquisition ($t = +1$), over-leveraged acquired firms' mean leverage falls to 20.0%. The decline continues in subsequent years. Mean leverage for the 5 post-acquisition years (16.4%) is 11.8 percentage points lower ($p < 0.01$) than the average for years [−5, −1]. The largest change by far (−14.4 percentage points) occurs around the acquisition event [−1, +1]. The rightmost 4 columns of Table 3 describe previously under-leveraged firms. Their mean leverage had been falling for the 5 years preceding acquisition; it increased by 5.3% during the acquisition year ($t = 0$). Mean leverage for the 5 post-acquisition years (20.4%) is 4.3 percentage points higher ($p < 0.01$) than the average for years [−5, −1].[16] Once again, the largest leverage change occurred in the [−1, +1] interval around the deal's completion: 8.5% ($p < 0.001$). Table 3 thus establishes that acquired firms' mean and median capital structures move toward their targets following the acquisition date.

We confirm the univariate results in Table 3 by estimating a multivariate difference regression:

$$\text{LEVERAGE}_{i,t} = \alpha + \beta \text{AFTER}_{i,t} + \gamma X_{i,t-1} + \delta Z_{i,t} + \theta_i + \tau_t + \varepsilon_{i,t}, \tag{3}$$

where AFTER is a binary variable that takes a value of 1 during and after the acquisition ($t \geq 0$). Its estimated coefficient measures the effect of acquisition on leverage.[17] $X_{i,t-1}$ represents three alternative sets of firm-level leverage determinants, explained below. $Z_{i,t}$ is a set of the target's country-level variables to account for variation in the availability of external finance: total private credit to GDP, stock market capitalization to GDP, and nominal GDP growth (Erel et al. (2015)). θ are a set of firm fixed effects to control for unobserved firm heterogeneity; τ are a set of year fixed effects to control for changing macroeconomic conditions, and ε is a random error term.

These are our "main" results. The coefficient of primary interest is β, which measures the extent to which firms changed their average leverage after being acquired, beyond any effect of the changing control variables. We estimate equation (3) separately for each group of acquired firms (optimized, over-leveraged, and under-leveraged). We include three alternative sets of control variables ($X_{i,t-1}$)

[16] Table 3 further indicates similar, significant changes in mean leverage between the [−2, −1] and [+1, +2] periods.

[17] Because AFTER = 1 only for acquired firms, the probability of being acquired depends on leverage and LEVDEV through (2). Panel B of Table 5 provides an instrumental variables treatment of AFTER that is designed to eliminate this potential correlation with the residuals in (3).

TABLE 3

Univariate Leverage Ratios Around Acquisition

Table 3 shows acquired firms' leverage values in relation to the year the acquisition is completed (year 0) and tests of the differences for various windows. The sample is separated for three sets of firms based on their deviation from target leverage at $t = -1$. "Optimized" firms at their leverage targets prior to acquisition; firms that are "under-leveraged" prior to acquisition; firms that are "over-leveraged" prior to acquisition. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level correspondingly. Variable definitions are provided in the Appendix.

	Optimized Target Firms				Over-Leveraged Target Firms				Under-Leveraged Target Firms			
Timeline	Mean	Median	Std. Dev.	*N*	Mean	Median	Std. Dev.	*N*	Mean	Median	Std. Dev.	*N*
−5	0.088	0.007	0.151	432	0.234	0.202	0.209	1,037	0.203	0.140	0.206	1,270
−4	0.084	0.003	0.147	526	0.255	0.224	0.210	1,260	0.187	0.131	0.200	1,577
−3	0.086	0.000	0.161	640	0.275	0.246	0.214	1,514	0.172	0.113	0.190	1,928
−2	0.084	0.001	0.157	783	0.300	0.274	0.213	1,834	0.146	0.081	0.175	2,268
−1	0.065	0.000	0.139	1,105	0.344	0.311	0.208	2,225	0.100	0.032	0.144	2,753
0	0.067	0.000	0.152	1,105	0.237	0.192	0.218	2,225	0.153	0.063	0.197	2,753
1	0.065	0.000	0.156	1,105	0.200	0.128	0.217	2,225	0.185	0.100	0.219	2,753
2	0.088	0.001	0.170	638	0.177	0.098	0.206	1,795	0.194	0.121	0.217	2,213
3	0.087	0.000	0.171	470	0.160	0.082	0.194	1,508	0.209	0.136	0.230	1,828
4	0.097	0.001	0.179	361	0.148	0.062	0.187	1,245	0.213	0.141	0.230	1,490
5	0.087	0.000	0.169	276	0.135	0.048	0.180	1,046	0.217	0.145	0.232	1,269
Total				7,441				17,914				22,102
Averages for period −5 to −1	0.082	0.002		3,486	0.282	0.252		7,870	0.161	0.100		9,796
Averages for period +1 to +5	0.085	0.000		2,850	0.164	0.084		7,819	0.204	0.129		9,553
Change	0.003	−0.002			−0.118***	−0.168***			0.043***	0.029***		
Averages for period −2 to −1	0.075	0.000		1,888	0.322	0.293		4,059	0.123	0.057		5,021
Averages for period +1 to +2	0.076	0.001		1,743	0.188	0.113		4,020	0.190	0.110		4,966
Change	0.001	0.001			−0.134***	−0.180***			0.067***	0.053***		
Change in leverage −1 and + 1	0.000	0.000			−0.144***	−0.183***			0.085***	0.085***		

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TABLE 4

Leverage Changes Following Acquisition

Table 4 reports estimation results from regression model (3) for the sample of acquired firms. The sample period includes up to 5 years on either side of the acquisition. AFTER is equal to unity after the deal is completed. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels correspondingly. Variable definitions are provided in the Appendix.

	Dependent Variable = Acquired Firm's Leverage								
	Optimized Target Firms			Over-Leveraged Target Firms			Under-Leveraged Target Firms		
	1	2	3	4	5	6	7	8	9
AFTER	0.0001	0.005	0.005	−0.090***	−0.086***	−0.089***	0.047***	0.039***	0.039***
	(0.003)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.003)	(0.004)	(0.004)
ln(TOTAL_ASSETS)$_{t-1}$	0.006*	−0.008	−0.007	0.042***	0.048***	0.051***	0.037***	0.023***	0.026***
	(0.003)	(0.005)	(0.005)	(0.004)	(0.005)	(0.005)	(0.003)	(0.005)	(0.005)
TANGIBILITY$_{t-1}$	0.099***	0.097***	0.095***	0.113***	0.138***	0.130***	0.130***	0.105***	0.091***
	(0.018)	(0.025)	(0.025)	(0.015)	(0.020)	(0.020)	(0.014)	(0.019)	(0.019)
GROWTH$_{t-1}$	−0.001	−0.003	−0.002	−0.000	−0.002	0.000	0.000	0.001	0.003
	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)
ROA$_{t-1}$	−0.016**		−0.016	−0.113***		−0.108***	−0.111***		−0.120***
	(0.007)		(0.011)	(0.012)		(0.017)	(0.011)		(0.016)
CAPEX$_{t-1}$		0.035*	0.035*		0.022	0.021		0.110***	0.111***
		(0.020)	(0.020)		(0.017)	(0.017)		(0.015)	(0.015)
ST_DEBT$_{t-1}$		0.006	0.006		0.013**	0.014**		0.006	0.007
		(0.004)	(0.004)		(0.006)	(0.005)		(0.004)	(0.004)
FIRM_AGE$_{t-1}$		−0.008	−0.008		−0.067***	−0.064***		0.007	0.009
		(0.008)	(0.008)		(0.014)	(0.014)		(0.011)	(0.011)
PRIVATE_CREDIT/GDP$_{t-1}$	−0.000	−0.000	−0.000	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
MAKRET_CAP/GDP$_{t-1}$	0.000	0.000	0.000	0.000	0.001***	0.001***	0.000	−0.000	−0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GDP_GROWTH$_{t-1}$	−0.000	−0.001	−0.001	−0.000	0.002	0.002*	−0.000	−0.000	−0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Intercept	−0.013	0.325***	0.319***	−0.557***	−0.526***	−0.568***	−0.572***	−0.361***	−0.398***
	(0.062)	(0.104)	(0.102)	(0.069)	(0.099)	(0.098)	(0.059)	(0.084)	(0.082)
FIRM and YEAR FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.842	0.853	0.853	0.627	0.647	0.649	0.615	0.634	0.639
N	5,785	3,577	3,577	15,505	9,399	9,399	19,010	11,757	11,757

drawn from theory and recent studies (e.g., Brav (2009)), although our main results do not vary substantially across those three specifications.

Our simplest specification in Table 4 (columns 1, 4, and 7) controls only for the four Rajan–Zingales variables and three financial measures $(Z_{i,t})$ related to the target firm's country. We include ROA as in Rajan and Zingales (1995). However, Hovakimian, Opler, and Titman (2001) argue that ROA may mechanically affect leverage through retained earnings. When we add further explanatory variables (e.g., in columns 2 and 3), we both include and exclude ROA. The added explanatory variables control for lagged capital expenditures, firm age, and the proportion of short-term debt in total debt. Capital expenditures provide an indicator of firm growth. We control for firm age because older firms tend to pay lower interest rates and are less likely to pledge collateral (Petersen and Rajan (1994), Berger and Udell (1995), and Petersen and Rajan (2002)). The proportion of short-term debt in total debt proxies for contracting problems: credit-constrained firms often cannot issue long-term debt (Faulkender and Petersen (2006)). Estimated AFTER coefficients within each leverage group remain essentially unchanged across the three alternative sets of control variables.

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The first three columns of Table 4 report results for the subsample of optimized target firms. The estimated coefficients on AFTER are positive but neither large nor statistically significant, consistent with optimized target firms leaving their leverage unchanged following an acquisition. Columns 4–6 indicate that over_leveraged target firms carry significantly negative coefficients on AFTER. These acquired firms reduce their leverage after their acquisition by nearly 9.0 percentage points (approximately one-half of a standard deviation). Columns 7–9 indicate that under-leveraged acquired firms significantly increase their leverage following acquisition, by roughly 4 percentage points. These conditional leverage changes are consistent with the dynamic trade-off theory of leverage (Hennessy and Whited (2005), Leary and Roberts (2005), and Lemmon et al. (2008)), and with acquired firms becoming less financially constrained.

C. Leverage Changes: Difference-in-Difference Results

It is well known that the significant AFTER coefficients in Table 4 might reflect some omitted variables that tended to affect all firms in the same way. Such a threat to our estimates may be less serious in our case because the omitted effects would have to affect firms differently according to their initial leverage deviations. Nevertheless, we reestimated the coefficient on AFTER using a difference-in-difference model:

$$(4)\qquad \text{LEVERAGE}_{i,m,t} = \alpha + \beta_1 \text{AFTER}_{it} + \beta_2 \text{AFTER}_{i,t} \times \text{TREATED}_{i,m,t} + \gamma X_{i,m,t} + \delta Z_{i,t} + \theta_{i,m} + \tau_t + \varepsilon_{i,m,t},$$

where $\text{TREATED}_{i,m} = 1$ if the firm is an actual target firm in deal m and $= 0$ for matched, unacquired firms. The notes to Table 5 describe alternative sets of matching firms used in the analysis in Panels A and C). AFTER_{it} is defined following equation (3). $X_{i,m,t}$ represents two alternative sets of firm-level leverage determinants; basic firm-level controls include the four Rajan–Zingales (1995) factors: firm size, asset tangibility, growth, and profitability and all firm-level controls also include capital expenditures, the proportion of short-term debt in total debt, and firm age. $Z_{i,t}$ is a set of country-level variables (for the target and the matches) to account for variation in the availability of external finance: total private credit to GDP, stock market capitalization to GDP, and nominal GDP growth (Erel et al. (2015)). $\theta_{i,m}$ is a set of firm effects for acquired firms and their matches. τ_t is a time (year) fixed effect. The coefficient on the interaction term $\text{AFTER}_{i,t} \times \text{TREATED}_{i,m,t}$ measures the difference in leverage between actual targets and their control firms.

Table 5 reports estimation results for equation (4). Panel A is based on the set of matching firms identified for the logit regression (2). The coefficients on AFTER × TREATED measure the effect of an acquisition on leverage. In Panel B, we address the endogeneity of AFTER, which may occur if a firm's probability of being acquired is affected by its leverage. We employ the same matched sample as in Panel A while instrumenting the variable AFTER with the probability of the firm being acquired according to the model equation (2). Specifically, for each treated and control firm, we create an instrumented variable $\widehat{\text{AFTER}}(\text{PREDICTED}) = 1$ if the firm's probability of being acquired exceeds 50%, else 0. The instrumented variable is then not correlated with the residual in (3). Finally, Panel C of Table 5

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TABLE 5

Leverage Changes Following Acquisition: Difference-in-Differences Estimates

Table 5 presents difference-in-differences results of the leverage regression (4). In Panel A the treated (acquired) firms are matched to control firms following Bena and Li's (2014) industry-size-year-country match. In Panel B, we employ the same matched sample as in Panel A but we instrument the variable AFTER using the predicted probability of being acquired [$\widehat{\text{AFTER}}$(Predicted) = (Probability of being acquired > 0.5)]. The probability of being acquired comes from equation (2). In Panel C we undertake an alternative matching technique by selecting control firms on the basis of propensity score matches in the probability of being acquired. For each target firm, we find a match in the year prior to the acquisition (−1). AFTER is a dummy variable equal to unity after the deal is completed [0, +5] and 0 otherwise. The set of basic firm-level controls includes the four Rajan–Zingales (1995) variables: firm size, asset tangibility, growth, and profitability. The set of all firm-level controls also includes capital expenditures, the proportion of short-term debt in total debt, and firm age. Country-level controls include total private credit to GDP, stock market capitalization to GDP, and nominal GDP growth of the target firm's country. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level correspondingly. Variable definitions are provided in the Appendix.

	Dependent Variable: Leverage of Acquired Firms and Their Matches					
	Optimized Target Firms		Over-Leveraged Target Firms		Under-Leveraged Target Firms	
	1	2	3	4	5	6
Panel A. Difference-in-Differences Using a Sample of Industry-Size-Year-Country Matched Firms Following Bena and Li						
AFTER	−0.002	−0.001	−0.002	−0.000	−0.001	−0.002
	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
AFTER × TREATED	0.001	0.007*	−0.088***	−0.093***	0.055***	0.056***
	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)	(0.003)
Basic firm-level controls	Yes		Yes		Yes	
All firm-level controls		Yes		Yes		Yes
Country-level controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm and Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.772	0.776	0.734	0.754	0.733	0.753
N	19,117	14,051	46,563	33,455	58,706	43,374
Panel B. Difference-in-Differences Using A Sample of Industry-Size-Year-Country Matched Firms Following Bena and Li and Instrumented After						
$\widehat{\text{AFTER}}$(Predicted)	−0.011	−0.012	0.016	0.017	−0.008	0.002
	(0.009)	(0.010)	(0.017)	(0.017)	(0.005)	(0.008)
$\widehat{\text{AFTER}}$(Predicted) × TREATED	−0.005	0.003	−0.085***	−0.085***	0.072***	0.087***
	(0.011)	(0.017)	(0.030)	(0.030)	(0.009)	(0.018)
Basic firm-level controls	Yes		Yes		Yes	
All firm-level controls		Yes		Yes		Yes
Country-level controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm and Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.772	0.776	0.744	0.746	0.731	0.748
N	19,117	14,051	46,563	33,455	58,706	43,374
Panel C. Difference-in-Differences Using a Sample of Firms Matched on Their Acquisition Propensity Score From Regression (2)						
AFTER	0.000	0.001	−0.000	−0.000	−0.002	−0.004**
	(0.003)	(0.004)	(0.002)	(0.003)	(0.002)	(0.002)
AFTER × TREATED	0.000	0.006	−0.082***	−0.085***	0.050***	0.055***
	(0.004)	(0.004)	(0.004)	(0.005)	(0.003)	(0.004)
Basic firm-level controls	Yes		Yes		Yes	
All firm-level controls		Yes		Yes		Yes
Country-level controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm and Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.768	0.773	0.733	0.750	0.734	0.753
N	12,365	9,688	29,556	22,802	37,996	30,189

reports estimation results for equation (4) when we use the actual AFTER variable, as in Panel A, and select matching firms on the basis of propensity score matches in the probability of being acquired, from equation (2).[18]

[18]We match using the nearest neighbor method, no replacement, within common support and with a caliper of 0.01 in the respective exact category of country, industry, and year.

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In Panels A–C of Table 5, only the TREATED (acquired) firms manifest significant changes in their capital structures. Furthermore, the estimated effect of acquisition is similar to what we find in Table 4: Post-acquisition leverage falls 8 or 9 percentage points for over-leveraged firms and rises between 5 and 8 percentage points for under-leveraged firms. Because the results from the difference regressions in Table 4 coincide so closely with those from the difference-in-difference tests in Table 5, we conclude that the acquired firms' leverage changes are not driven by some omitted shock(s) affecting similar firms. Therefore, our subsequent analyses continue to utilize the simpler specification equation (3), which allows us to perform a broader range of tests than a difference-in-difference specification.

D. Acquisition-Related Changes in LEVDEV

Tables 3–5 show that over-leveraged firms lower their leverage and under-leveraged firms raise their leverage following acquisition. Yet this behavior does not necessarily imply that firms move toward their target leverage. We now estimate a regression explaining post-acquisition changes in acquired firms' LEVDEV, controlling for firm characteristics that might affect the cost of implementing leverage adjustments[19]:

$$(5) \quad \Delta \text{LEVDEV}_{i,t} = \alpha + \beta L_{i,t-1} + \gamma C_{i,t-1} + \delta L_{i,t-1} C_{i,t-1} + \varphi Z_{i,t} + \vartheta_c + \mu_j + \varepsilon_{i,t},$$

where $\Delta\text{LEVDEV}_{i,t}$ is the change in leverage deviation over one of the indicated intervals in Table 6.

$L_{i,t-1}$ is a vector of two binary variables (OVER_LEVERAGED and UNDER_LEVERAGED) that are defined following model (2). $C_{i,t-1}$ is a vector of two firm-level characteristics that might affect a firm's cost of changing leverage; LEVERAGE is the leverage firm's leverage ratio at the end of year $t-1$, and BANKRUPTCYRISK is Altman's (2013) Z-score at the end of year $t-1$, adjusted for private firms, used here as a proxy for the cost of rebalancing the firm's leverage (Leary and Roberts (2005)). A higher value of the BANKRUPTCYRISK indicates greater financial distress. $Z_{i,t}$ is the set of the target's three country-level variables defined following equation (3) above. ϑ_c and μ_j represent country and industry fixed effects.

Over-leveraged firms might find it more difficult (or costly) to adjust their leverage ratio than their under-leveraged counterparts, for two reasons. First, issuing equity is probably more expensive than issuing debt and this difference could reasonably rise with the firm's initial leverage. Second, firms with high bankruptcy risks might find it more difficult to raise their leverage at all.

We estimate (5) for four different intervals spanning and following the acquisition event. For an interval defined as $[n, m]$, the dependent variable in (5) is measured as the difference between leverage at the end of year $t = m$ less leverage at

[19]Harford et al. (2009) use a similar specification when they investigate acquiring firms' leverage changes following large cash acquisitions. We adjust their specification in two ways. First, we add three control variables characterizing the acquired firm's country (total private credit to GDP, stock market capitalization to GDP, nominal GDP growth). Second, we omit firm stock returns and bond ratings because our acquired firms are small and generally privately held.

TABLE 6

LEVDEV Changes Around the Acquisition Date

Table 6 contains the cross-sectional analysis (equation (5)) of the change in the leverage deviation over a time interval [n, m], which extends from the end of the year ($t+n$) to the end of the year ($t+m$). LEVERAGE is the target firm's leverage in the year prior to the acquisition (−1). All control variables, including BANKRUPTCYRISK and LEVERAGE are measured at the end of the year prior to the acquisition ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels correspondingly. Variable definitions are provided in the Appendix.

	Δ Leverage Deviation							
	[−1, 0]		[−1, 5]		[−1, 3]		[3, 5]	
	1	2	3	4	5	6	7	8
OVER_LEVERAGED	−0.067***	−0.010	−0.116***	−0.014	−0.110***	−0.026*	−0.047***	0.021
	(0.005)	(0.011)	(0.010)	(0.019)	(0.007)	(0.013)	(0.009)	(0.020)
UNDER_LEVERAGED	0.049***	0.062***	0.134***	0.136***	0.118***	0.124***	0.048***	0.046***
	(0.004)	(0.006)	(0.009)	(0.012)	(0.006)	(0.009)	(0.006)	(0.008)
LEVERAGE	−0.178***	0.0006	−0.320***	−0.037	−0.256***	−0.042	−0.102***	−0.036
	(0.019)	(0.028)	(0.030)	(0.055)	(0.023)	(0.039)	(0.030)	(0.041)
LEVERAGE × OVER_LEVERAGED		−0.278***		−0.494***		−0.381***		−0.180***
		(0.038)		(0.067)		(0.049)		(0.060)
LEVERAGE × UNDER_LEVERAGED		−0.081**		−0.014		−0.011		0.069
		(0.034)		(0.067)		(0.049)		(0.052)
BANKRUPTCYRISK	−0.002**	0.000	−0.002	−0.001	−0.001	0.000	−0.001**	−0.001
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.000)
BANKRUPTCYRISK × OVER_LEVERAGED		−0.002		−0.002		−0.002		−0.007*
		(0.002)		(0.003)		(0.002)		(0.004)
BANKRUPTCYRISK × UNDER_LEVERAGED		−0.0016*		−0.0003		−0.001		−0.001
		(0.001)		(0.002)		(0.001)		(0.001)
Country-level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
t-stat: $\lvert\beta_{Overlev}\rvert = \lvert\beta_{Underlev}\rvert$	−24.63***	−6.24***	−29.50***	−7.96***	−34.72***	−10.61***	−11.36***	−1.24
t-stat: $\lvert\beta_{Lev\times Overlev}\rvert = \lvert\beta_{Lev\times Underlev}\rvert$		−6.01***		−8.58***		−8.36***		−4.63***
Adj. R^2	0.237	0.249	0.483	0.511	0.439	0.459	0.165	0.180
N	4,700	4,700	2,055	2,055	3,060	3,060	1,956	1,956

the end of year $t=n$. (The interval [−1, 0] therefore describes the acquisition year alone.) The LEVERAGE and BANKRUPTCYRISK variables are measured in the year prior to the acquisition.

Table 6 presents estimation results. Odd-numbered columns (1 through 7) report the basic specification, which indicates that LEVDEV falls for over-leveraged firms and rises for under-leveraged firms compared to the (omitted) optimized firms. In other words, acquired firms significantly reduce their leverage deviations over all the intervals studied, rejecting Hypothesis 2. Comparing leverage adjustments across different time intervals provides information about the speed with which leverage adjustments are implemented (Hypothesis 3). During the acquisition year (column 1), a Wald test indicates that in absolute terms over-leveraged firms close significantly more of their LEVDEV before the end of the event year than under-leveraged firms do (t-stat = 24.63). Over-leveraged firms also seem to act more aggressively over time. For example, over- (under-) leveraged firms in column 3 show a −11.6% (+13.4%) leverage change by $t+5$. But the over-leveraged firms have completed nearly all of this adjustment (11% out of 11.6%) by the end of year 3 (see column 5), while under-leveraged firms have completed

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less (11.8% out of an eventual 13.4% change by year 5). In other words, the over-leveraged firms seem to close their LEVDEV gaps more quickly within the first 5 years, rejecting Hypothesis 3.

As expected, leverage generally carries significantly negative coefficients in the odd-numbered columns of Table 6, implying that more highly levered firms find it more difficult to close their LEVDEV. The even-number columns indicate that this effect is more substantial for over-leveraged firms. The BANKRUPTCYRISK coefficients are generally negative, indicating that more troubled firms make smaller leverage adjustments following their acquisitions, but the coefficients are not strongly significant.[20]

E. Asset Growth and Leverage Changes

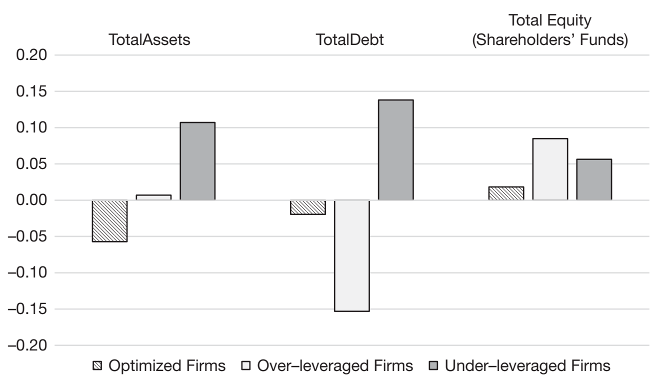
Having shown that acquired firms make big leverage adjustments, we now investigate how those leverage changes are implemented. Changing a firm's capital structure requires a change in debt, retained earnings, or shares outstanding.

Figure 2 describes acquired firms' changes for a 2-year window around the acquisition date, [−1, +1].[21] Optimized firms' assets shrink about 5% over this interval. Acquired over-leveraged firms change their total assets only slightly, consistent them having had high cash flow and/or good access to external capital markets prior to their acquisition. Over-leveraged firms reduce their leverage by retiring debt equal to about 15% of total assets and issuing new equity worth about

FIGURE 2

Asset, Debt, and Equity Around Acquisition [−1, +1]

Figure 2 shows assets, debt, and equity changes around acquisition [−1, +1] scaled by total assets in the year before acquisition. The sample is separated into three sets of firms based on their deviation from target leverage at $t = -1$: optimized firms at their leverage targets prior to acquisition, firms that are under-leveraged prior to acquisition, and firms that are over-leveraged prior to acquisition.



[20]The results in Table 6 might be affected by the gradual decline in the number of remaining independent firms in our sample as the estimation window widens. We confirm in Table IA-VII in the Supplementary Material that similar results hold when we estimate the same regressions on a sample of firms that provide data for the full [−5, +5] period.

[21]Note that the end of period $t-1$ is equivalent to the start of the acquisition year. Acquisitions can occur at any time during the year, so the plotted changes occur over a time period between 1 and 2 years long.

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8%, even while their assets remain relatively constant. In other words, previously over-leveraged firms reduce their leverage without purchasing new assets. Finally, under-leveraged firms are most likely to have faced strong financial constraints and these firms increase their total assets by more than 10% by the end of period $t+1$. To finance this large asset growth, previously under-leveraged firms raise their leverage by issuing more new debt than new equity.

Notice that the mean asset changes in Figure 2 differ from the summed changes in debt and equity. This reflects Amadeus' incomplete information about the market value of new equity. New shares typically sell for substantially more than their par value. The stock's par value is recognized in Amadeus' "Issued Capital" variable and the excess of share market price above par is reflected in an equity account called "Share Premium Account."[22] Amadeus does not report this amount separately, but only as an unspecified component of "Shareholders' Funds" (i.e., total equity), which includes a variety of items beyond the premium on new shares. Consequently, the "TOTAL_EQUITY" (Shareholders' Funds) information we plot in Figure 2 only approximates the firms' change in issued equity capital.[23] We urge readers to consider this fact when interpreting the regression coefficients in Table 7.

We further examine the patterns in Figure 2 by estimating four logit models of acquired firms' securities issuance:

$$P(I_{i,t}=1)=\alpha+\beta_1\text{OVER\_LEVERAGED}_{i,-1}+\beta_2\text{UNDER\_LEVERAGED}_{i,-1} \\ +\gamma\text{DEFICIT}_{i,t}+\delta X_{i,t-1}+\vartheta_c+\mu_j+\tau_t+\varepsilon_{i,t}, \quad (6)$$

TABLE 7

Issuance and Retirement of Debt and Equity

Table 7 shows the results of estimating the logit model (6) explaining acquired firms' changes in capital structure around the acquisition date. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level correspondingly. Variable definitions are provided in the Appendix.

	Window = [−1,1]			
	Prob(DEBT_ DECREASE =1)	Prob(DEBT _INCREASE =1)	Prob(TOTAL_EQUITY _DECREASE =1)	Prob(TOTAL_EQUITY _INCREASE =1)
	1	2	3	4
OVER_LEVERAGED$_{t-1}$	0.043*	−0.076***	−0.002	0.033*
	(0.026)	(0.025)	(0.020)	(0.020)
UNDER_LEVERAGED$_{t-1}$	−0.138***	0.120***	0.048**	−0.023
	(0.025)	(0.024)	(0.019)	(0.019)
DEFICIT$_t$	−0.307***	0.289***	−0.612***	0.694***
	(0.034)	(0.034)	(0.031)	(0.035)
Firm Controls	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Pseudo-R^2	0.077	0.093	0.138	0.158
N	4,197	4,193	4,937	4,941

[22]U.S. GAAP would categorize Amadeus' "share premium account" as "Additional Paid in Capital."

[23]It might appear that the change in total equity could be inferred from an acquisition's payment media. Unfortunately, Zephyr provides this information for fewer than 20% of the acquisitions sample (1,171 out of 6,083) and when there are multiple means of payment the data do not indicate the importance of each component.

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where $I_{i,t}$ is alternatively one of the following four indicator variables: DEBT_DECREASE$_{i,t}$ equals unity if firm i retires net debt worth more than 5% of its beginning-of-period total debt, otherwise 0.[24] DEBT_INCREASE$_{i,t}$ equals unity if firm i issues net debt worth more than 5% of its beginning-of-period total debt, otherwise 0. TOTAL_EQUITY_DECREASE$_{i,t}$ equals unity if firm i reduces its total equity by more than 5% of its beginning-of-period total equity capital, otherwise 0. TOTAL_EQUITY_INCREASE$_{i,t}$ equals unity if firm i increases its total equity by more than 5% of its beginning-of-period total equity capital, otherwise 0. OVER_LEVERAGED and UNDER_LEVERAGED are binary variables defined following equation (2). DEFICIT$_{i.t}$ proxies for a firm's need for external financing with a measure of industry-average fixed investments: the average change in fixed assets minus (cash and cash equivalents at the beginning of the period plus profit), divided by total assets for all firms in the same industry (except firm i). $X_{i,t-1}$ is a set of firm-level characteristics lagged 1 year: asset size, growth, bankruptcy risk score, and net working capital. Country (ϑ_c), industry (μ_j) and time (τ_t) fixed effects are included.

Table 7 reports the results from estimating (6) over the $[-1, +1]$ interval. The significant effects of industry deficit indicate that firms in industries with large net demand for new capital expenditures are more (less) likely to issue (retire) new debt *and* new equity. However, issuance decisions depend importantly upon a firm's LEVDEV. Across all specifications, the (unreported) control variables' coefficients generally carry appropriate signs. The reported coefficients on over-leveraged and under-leveraged measure issuance/retirement probabilities relative to that of the optimized firms.

Column 1 indicates that over-leveraged acquired firms are 4.3 percentage points more likely to decrease debt after their acquisition, while under-leveraged targets are 13.8 percentage points less likely to decrease debt. The debt increase patterns in column 2 complement those in column 1. Over-leveraged targets are 7.6 percentage points less likely to issue debt and under-leveraged firms are 12 percentage points more likely to issue debt. Columns 3 and 4 reveal a similar effect of mis-leverage on total equity changes. Over-leveraged firms are more likely than optimized firms to increase total equity and are no more likely to decrease it. Under-leveraged firms do the opposite: they manifest a significantly positive tendency to reduce total equity. We interpret Figure 2 and Table 7 as indicating that debt adjustments are more important than equity adjustments in implementing acquired firms' leverage changes following acquisition.

V. Leverage Targets Changing With Acquisition

Our baseline results rely on leverage targets computed from estimating (1) over the entire universe of Amadeus firms and across the entire sample period. Each acquired firm's computed leverage target is therefore assumed to reflect only its

[24]Previous authors applying the same methodology include Hovakimian et al. (2001), Korajczyk and Levy (2003), Leary and Roberts (2005), and Brav (2009). We also tested an alternative definition of issuing (retiring) debt when an absolute change in debt exceeds 5% of beginning-of-period *total assets*. The results are similar and available upon request.

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own cash flows and the effect of each financial variable remains the same before and after acquisition. However, an acquired firm's optimal leverage may change if it becomes associated with its new parent's asset composition and cash flow risks and such a change may be quickly reflected in the firm's leverage adjustments. Rapid leverage changes may accompany U.S. mergers, for which acquired firms are generally folded into a larger corporate entity. In Europe, however, acquired firms are much more likely to remain legally independent. Arguments for insulating an acquired firm's leverage target from its corporate parent include limited liability considerations (Khanna and Yafeh (2007), Belenzon, Lee, and Patacconi (2018), or Beaver, Cascino, Correia and McNichols (2019) or tax or regulatory issues (Kandel, Kosenko, Morck, and Yafeh (2013)).[25] More broadly, an EU legal principle (rooted in Roman law) requires any company's board of directors to make decisions that reflect their company's best interests, even if the company is a subsidiary of another firm.[26] Therefore, many group decisions must be approved by the subsidiary's board. Where this principle applies, business groups may manage credit risk at *both* the group *and* subsidiary levels.

Because our acquired firm's target leverage ratios may (or may not) change following acquisition, we repeat our basic analysis using different targets. Recall that we have heretofore used fitted values from equation (1) as target leverage ratios. We now estimate (1) for a sample including *only* stand-alone firms and use those coefficients to compute *pre-merger* leverage targets. Post-merger leverage targets are the fitted values from a modified leverage regression:

$$L_{ij,t} = \beta X_{ij,t-1} + \gamma \text{GROUP} X_{j,t-1} + \kappa_j + \theta_i + \tau_t + \varepsilon_{i,t}, \tag{7}$$

where $L_{ij,t}$ is leverage of subsidiary i in business group j at time t; $X_{ij,t}$ are subsidiary-specific characteristics (size, tangibility, growth, and profitability); $\text{GROUP}X_{j,t-1}$ are characteristics of business group j (group size, group tangibility, group growth, and group profitability); κ_j is a set of country dummy variables identifying the countries in which group j operates additional subsidiaries, intended to account for any potential tax issues. θ_i is a set of firm effects, and τ_t is a set of year fixed effects. We estimate equation (7) over a sample of firms that are subsidiaries of another firm, permitting an acquired firms' optimal leverage to reflect its parent's financial characteristics. We use the fitted coefficients from equation (7) to estimate acquired firms' target leverage ratios *following the merger*.

Table 8 clearly indicates that estimating equation (3) using the modified target estimates from (7) yields coefficients very similar to those reported in Table 4. Consider first the over- and under-leveraged subsamples. Compared to AFTER

[25]Posner (1976) argues that preserving limited liability within business groups is an important consideration that has often been overlooked in the finance literature. See also Cestone and Fumagalli (2005).

[26]An International Finance Corporation (World Bank Group) guide to corporate governance practices in the European Union can be accessed here: https://www.ifc.org/wps/wcm/connect/506d49a2-3763-4fe4-a783-5d58e37b8906/CG_Practices_in_EU_Guide.pdf?MOD=AJPERES&CVID=kNmxTtG.
The EU corporate law legislation can be accessed here: https://ec.europa.eu/info/business-economy-euro/doing-business-eu/company-law-and-corporate-governance_en
A survey of Deloitte that maps the responsibilities and restrictions of parent companies can be accessed here: https://www2.deloitte.com/content/dam/Deloitte/in/Documents/risk/Corporate%20Governance/in-gc-governance-of-subsidiaries-a-survey-of-global-companies-noexp.pdf.

TABLE 8

Alternative Estimates of Post-Acquisition

Table 8 contains regression results examining acquired firms' leverage changes after the acquisition event. The regression specification is identical to (3) but we have changed how we compute target leverage ratios. Prior to its acquisition, a firm's estimated leverage target is the fitted value from (1) estimated for a sample of stand-alone firms. Target leverage ratios after the acquisition are fitted values from (7) estimated over a sample of subsidiary firms. The sample covers the period of ± 5 years around the acquisition event. AFTER is a dummy variable that is equal to 0 before the acquisition year and equal to 1 for $t \geq 0$. *Basic firm-level controls* include the four Rajan–Zingales (1995) factors: firm size, asset tangibility, growth, and profitability. *All firm-level controls* also include capital expenditures, the proportion of short-term debt in total debt, and firm age. Country-level controls are total private credit to GDP, stock market capitalization to GDP, and nominal GDP growth. All specifications include a set of firm and year fixed effects. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level correspondingly. The definitions of all variables are provided in the Appendix.

	Dependent Variable: Acquired Firm's Leverage$_t$					
	Optimized Target Firms		Overleveraged Target Firms		Underleveraged Target Firms	
	1	2	3	4	5	6
AFTER	−0.007**	−0.013***	−0.091***	−0.082***	0.056***	0.047***
	(0.003)	(0.004)	(0.004)	(0.005)	(0.004)	(0.005)
Basic firm-level controls	Yes		Yes		Yes	
All firm-level controls		Yes		Yes		Yes
Country-level controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm and Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.768	0.759	0.612	0.63	0.603	0.622
N	7,776	4,818	15,090	9,306	16,204	10,259

coefficients of about −8.9% (+3.9%) for over- (under-) leveraged firms in the full model in Table 4 (columns 6 and 9), we find coefficients of −8.2% (+4.7%) using the new target estimates in Table 8 (columns 4 and 6). Such similar results reflect relatively small target changes and the high correlation between the targets in Table 4 and those in Table 8.[27] The situation for optimized firms is a bit different. Table 4 shows no significant change in leverage following acquisition for these firms, while the coefficient on AFTER in Table 8 indicates that optimized firms' leverage falls by a small, but statistically significant, amount: between −0.7% and − 1.3%. These negative changes are consistent with a small decline in post-acquisition leverage targets even if there is no change in the importance of financial frictions. Qualitatively, one might also take the smaller adjustment of over-leveraged firms (−8.2% vs. −8.9% in Tables 4 and 8, respectively) and the larger adjustment of under-leveraged firms (+4.7% vs. +3.9%) as consistent with an overall decline in leverage targets.

Our strong conclusion from Table 8 is that separately estimating pre- and post-acquisition leverage targets makes no qualitative difference to our overall assessment that an acquisition hastens adjustments toward the acquired firms' target leverage ratios.

VI. Robustness

We undertook a variety of procedural revisions to test whether our results depend on any unusual feature of the data set or of our estimation methods.

[27]The LEVDEV changes estimated from regression (7) average only 0.4 percentage points, with similar changes for all three leverage groups. Over the entire sample, the correlation between the targets underlying Table 4 and those underlying Table 8 is 0.84. This correlation varies little with the firms' pre-merger leverage status: Optimized firms' targets have a correlation of 0.87, while under- (over-) leveraged acquired firms' targets have a correlation of 0.84 (0.82).

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A. Partial Adjustment Model of Firm Leverage

Although we have estimated leverage targets using a static regression specification (1), many recent papers assume that a firm's leverage follows a dynamic, partial adjustment process. To test whether our results are sensitive to this choice, we estimate each firm's target leverage from a partial adjustment model with firm fixed effects (Flannery and Rangan (2006)).

$$L_{i,t} - L_{i,t-1} = \lambda\left(L^{*}_{i,t} - L_{i,t-1}\right) + \varepsilon_{i,t}, \tag{8}$$

where $L_{i,t} - L_{i,t-1}$ is the actual change in a firm's leverage, and $L^{*}_{i,t} - L_{i,t-1}$ is the distance between the firm's leverage and its target. λ captures the speed of adjustment to the target leverage ratio.

Target leverage is a function of 1-year lagged leverage determinants ($X_{i,t-1}$, defined following equation (1)) and firm fixed effects (θ_i):

$$L^{*}_{i,t} = \beta X_{i,t-1} + \theta_i. \tag{9}$$

Combining equations (8) and (9), we get

$$L_{i,t} = (\lambda\beta)X_{i,t-1} + (1-\lambda)L_{i,t-1} + \lambda\theta_i + \varepsilon_{i,t}. \tag{10}$$

Equation (10) is estimated in first differences using generalized method of moments (GMM). All regressors are assumed to be endogenous and year dummies are included to reduce contemporaneous autocorrelation (Arellano and Bond (1991)). As for our initial estimate of equation (1), we estimate a separate regression model for all firms within each country and use the estimated coefficients to compute a leverage target for each acquired firm in the same country. Estimation results for each sample country are reported in Panels A and B in the Table IA-IV of the Supplementary Material.[28] Within each country, target estimates from equation (1) have a mean correlation of 0.72 with those from equation (10).[29] The correlation across all firms in all countries is 0.69.

Table 9 reports the results of re-estimating (3) using leverage targets calculated from the dynamic panel regression (10). As in Table 4, leverage at over- (under-) leveraged acquired firms drops (rises) significantly, although the estimated merger effects are somewhat smaller here. We conclude that our results are robust to alternative models of leverage selection.

B. Cross-Country Differences

Institutional differences might make cross-border deals different from those completed within a single national jurisdiction. We investigate the potential effects

[28]Because using many instruments may bias coefficient estimates, we reduced the number of instruments by collapsing the lagged untransformed control variables as suggested by Roodman (2009). Each country's resulting GMM model fails to reject the null hypotheses that the over-identifying restrictions are valid (according to Hansen's J statistic) and that the second order autocorrelation across firms is 0 (as measured by the Arellano–Bond test statistic).

[29]Panel C in Table IA-IV of the Supplementary Material indicates that the within-country average correlations range between 0.31 and 0.87.

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TABLE 9

Robustness Check: Partial Adjustment Model for Estimating Target Leverage

Table 9 reports estimation results for equation (3) when post-acquisition target leverage is calculated using a partial adjustment model (equation (10))). AFTER is a dummy variable that takes a value of 1 after the deal is completed [0, +5] and 0 otherwise. Basic firm-level controls include the four Rajan–Zingales (1995) factors: firm size, asset tangibility, growth, and profitability. Specifications with all firm-level controls also account for capital expenditures, the proportion of short-term debt in total debt, and firm age. Country-level controls are total private credit to GDP, stock market capitalization to GDP, and nominal GDP growth. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level correspondingly. Variable definitions are provided in the Appendix.

	Dependent Variable: Acquired Firm's Leverage$_t$					
	Optimized		Over-Leveraged		Under-Leveraged	
	1	2	3	4	5	6
AFTER	−0.001	−0.001	−0.032***	−0.031***	0.023***	0.014***
	(0.006)	(0.007)	(0.003)	(0.004)	(0.004)	(0.004)
Basic firm-level controls	Yes	Yes	Yes	Yes	Yes	Yes
All firm-level controls	No	Yes	No	Yes	No	Yes
Country-level controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm and Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.475	0.492	0.620	0.637	0.494	0.566
N	8,486	5,112	22,474	13,956	9,269	5,622

of cross-border deals in two ways. First, we reestimate the main regression specification (3) in Table 4 for the subset of acquisitions for which both firms resided in the same country (Panel A of the Table IA-V of the Supplementary Material) versus different countries (Panel B).[30] The estimation results for both subsets closely resemble those in Table 4: Leverage remains unchanged for the optimized firms, while it falls (rises) significantly after acquisition for over- (under-) leveraged firms. We conclude that our findings are not driven by any special feature of cross-border acquisitions.

C. Diversifying Transactions

Some acquisitions constitute operational decisions, such as purchasing a competitor or a supplier. Other acquisitions may have more to do with diversification benefits than with the acquirer's existing lines of business. Kaplan and Weisbach (1992) find that firms involved in diversifying acquisitions are almost four times more likely to divest their acquisition than were firms that had acquired related targets. In other words, the pressure to adjust an acquired firm's leverage might vary with the parent's reason for making the acquisition. We therefore classified our mergers into those representing horizontal, vertical, and diversifying transactions, using the methodology of Fan and Goyal (2006) and Ahern and Harford (2014). We then replicated Table 4 for each merger type's subsample and report the results in Table IA-VI of the Supplementary Material. We continue to find over- (under-) leveraged firms reducing (raising) their leverage following all types of acquisitions.

[30]The specification in Panel B is identical to equation (3), with the addition of fixed effects for the target's and the acquirer's countries.

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D. Attrition

Note that the number of observations in Table 6 declines as we move away from the acquisition year, which reflects the falling number of acquired firms that remain independently reported in Amadeus following their acquisition. It may therefore be possible that our findings about leverage changes apply only to firms that, for some unknown reason, take longer to integrate into the acquiring firm's financial accounts. To determine if this attrition is generating our leverage results, we test the robustness of our findings by focusing on firms that remain in the sample continuously over the periods $[-5, +5]$, $[-1, +5]$, $[-1, +4]$, $[-1, +3]$ around the acquisition. Table IA-VII of the Supplementary Material indicates that our results remain unchanged across these intervals.

E. Small Versus Large Acquisitions

If larger acquired firms tend to have better capital market access, we might expect the post-acquisition leverage changes to be less substantial. We therefore assess whether target size (in dollars of total assets) affects our results. We reestimate equation (3) separately for small and large targets, determined as target size in the bottom or top quartile. The results in Table IA-IX of the Supplementary Material indicate similar coefficients for both samples.

F. No Change in Total Assets

An acquired firm's post-acquisition leverage could reflect decisions by the new parent to liquidate some target firm assets or to move some of the parent's assets to the target's balance sheet. To address this concern, we re-estimate regression (3) for a subsample of mergers for which the target's total assets changed by less than 10% in the 2 years following the acquisition. The results in Table IA-X of the Supplementary Material closely resemble our main estimates, suggesting that our leverage adjustment results reflect true leverage changes rather than large asset shifts.

VII. Summary and Conclusion

This article analyzes the effect of acquisitions on the capital structure of European target firms, most of which are not publicly traded. Erel et al. (2015) conclude that this sort of merger substantially reduces the target's financial frictions; we investigate whether reduced financial frictions cause (permit) acquired firms to move toward their leverage targets. Merging firm-level financial information from Amadeus with merger information from the Zephyr database, we construct a data set of 6,083 European acquisitions over the period 1999–2015. Because European firms must generally report financial information regardless of their ownership status, these data allow us to observe acquired firms' balance sheets before and after the acquisition event. We estimate an optimal ("target") leverage ratio for each acquired firm and investigate whether actual leverage moves toward target leverage following an acquisition.

We find that firms with larger deviations from target leverage are more likely to be acquired, perhaps because the acquirer can increase the target firm's value by reducing its cost of adjusting leverage. By moving target firms closer to their optimal leverage, the new parent increases the subsidiary's market value (Korteweg (2010)). This effect on takeover probability is slightly (and significantly) larger for over-leveraged potential targets, but the same qualitative effect occurs for under-leveraged potential targets. More mis-leveraged firms are more likely to be acquired than are similar firms with minimal deviations from their target leverage ratios.

Our main conclusions concern leverage adjustments following a firm's acquisition. We find that newly acquired firms move rapidly toward their target leverage in the year or two following acquisitions, presumably by taking advantage of the acquirer's capital market access and/or its internal capital market. Over- and under-leveraged firms both exhibit sharp reversals of pre-acquisition leverage trends (see Figure 1 and Table 3). To the extent that this adjustment occurs through securities issuance, the largest changes occur in outstanding debt. Previously over-leveraged (under-leveraged) firms are more likely to retire (issue) debt after being acquired.

The rapid leverage adjustment we document carries important implications for the tradeoff theory of capital structure with adjustment costs. First, it shows that our computed targets are economically meaningful to the new subsidiary firms. In Europe, even subsidiaries seem to care about their leverage. Second, the target adjustment model recognizes two acquisition features that might induce unusually large post-acquisition leverage changes. As in Erel et al. (2015), the acquisition may reduce financial frictions that had limited the extent of adjustment toward target leverage (Fischer et al. (1989)). In addition, an acquisition might change the acquired firm's optimal (target) leverage ratio. Even with unchanged financial frictions, this might generate unusually large leverage changes following an acquisition. Based on the magnitude of our empirical results, we believe that the reduction in financial frictions is likely to account for most of the post-acquisition leverage adjustment. Regardless of the exact causation, it appears that the opportunity to move leverage closer to its target plays an important role in the market for small European firms.

Appendix. Variable Definitions

LTDB: Long-term financial debts (e.g., to credit institutions (loans and credits), bonds). *Note:* Bureau van Dijk's (BvD) variable name LTDB.

LOAN: Short-term financial debts (e.g., to credit institutions + part of long-term financial debts payable within the year, and bonds) (LOAN).

TOTAL_ASSETS: Book value of total assets (TOAS).

LEVERAGE: Total debt (short- and long-term) to total assets, = ((LTDB+LOAN)/TOAS).

ST_DEBT: Short-term debt scaled by total debt (LOAN/(LTDB+LOAN)).

TARGET_LEVERAGE: The fitted value of the specified leverage regression, winsorized at zero and unity.

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LEVDEV: Actual leverage less estimated target leverage.

OVER_LEVERAGED: A dummy variable equal to 1 actual leverage exceeds their target by more than 1% of total assets.

UNDER_LEVERAGED: A dummy variable equal to 1 target leverage is less than their actual leverage by more than 1% of total assets.

OPTIMIZED: A dummy variable equal to 1 if actual leverage lies within ±1% of total assets of their target.

ln (TOTAL_ASSETS): Log of book value of total assets (ln(TOAS)).

GROWTH: Sales scaled by lagged sales ($\text{TURN}_t/\text{TURN}_{t-1}$).

CAPEX: Capital expenditures scaled by total assets. ((($\text{FIAS}_t - \text{FIAS}_{t-1}) + \text{DEPR}_t$)/$\text{TOAS}_t$).

TANGIBILITY: Tangible fixed assets scaled by total assets. (TFAS/TOAS).

ROA: EBIT scaled by total assets. (OPPL/TOAS).

CASH_FLOW: Cash flow scaled by total assets. (CF/TOAS).

CASH: Cash scaled by total assets. (CASH/TOAS).

AGE: Year minus year of incorporation. (YEAR − YEARINC+1).

MEDIAN_INDUSTRY_LEVERAGE: Median leverage in each 2-digit NACE industry each year.

INTANGIBILITY: Intangible fixed assets scaled by total assets.

DEFICIT: An average change ((beg year + end of year)/2) in fixed assets (minus (cash and equivalents at the beginning of the period plus profit), divided by total assets of all firms in the same industry (except the company itself).

NET_WORKING_CAPITAL: (work in progress + trade debtors + other current assets − trade creditors)/total assets (WKCA/TOAS).

BANKRUPTCYRISK: Inverse Altman Z-score adjusted for private firms (Altman (2013)). The model for manufacturing firms is (Z') and for service firms is (Z''). We use NACE classification to determine whether the firm belongs to the manufacturing (10–33) and nonmanufacturing.

$$Z' = 0.717(X_1) + 0.847(X_2) + 3.107(X_3) + 0.420(X_4) + 0.998(X_5),$$

$$Z'' = 6.56(X_1) + 3.26(X_2) + 6.72(X_3) + 1.05(X_4),$$

where X_1 is the working capital to total assets ratio (WKCA/TOAS); X_2 is the retained earnings to total assets (OSFD/TOAS); X_3 is EBIT to total assets ratio (OPPL/TOAS); X_4 is the book value of equity to book value of total liabilities ratio ((SHFD/(LTDB+LOAN)); X_5 is the sales to total assets ratio (TURN/TOAS).

PRIVATE_CREDIT/GDP: Private credit by deposit money banks to GDP. Calculated for the country of the target firm. Source: Global Financial Development Database, World Bank.

MARKET_CAP/GDP: Value of listed shares to GDP. Calculated for the country of the target firm. Source: IMF International Financial Statistics.

GDP_GROWTH: Annual percentage of the nominal growth rate of GDP in local currencies. Calculated for the country of the target firm. Source: World Bank.

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DEBT_DECREASE: A binary variable equal to unity if the firm retires net debt worth more than 5% of its beginning-of-period total debt, otherwise 0 (see Table 7).

DEBT_INCREASE: A binary variable equal to unity if the firm issues net debt worth more than 5% of its beginning-of-period total debt, otherwise 0 (see Table 7).

TOTAL_EQUITY_DECREASE: A binary variable equal to unity if the firm reduces its total equity by more than 5% of its beginning-of-period total equity capital, otherwise 0 (see Table 7).

TOTAL_EQUITY_INCREASE: A binary variable equal to unity if the firm increases its total equity by more than 5% of its beginning-of-period total equity capital, otherwise 0 (see Table 7).

TOP_LEVERAGE_TERCILE: A binary variable equal to unity if the firm's LEVERAGE is in the sample's highest one-third (see Panel B of Table 2).

BOTTOM_LEVERAGE_TERCILE: A binary variable equal to unity if the firm's LEVERAGE is in the sample's lowest one-third (see Panel B of Table 2).

Supplementary Material

Supplementary Material for this article is available at https://doi.org/10.1017/S0022109022000436.

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