A Review of Empirical Capital Structure Research and Directions for the Future

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Abstract

This article reviews empirical capital structure research, concentrating on papers published since 2005. We begin by documenting three dimensions of capital structure variation: cross firm, cross industry, and within firm through time. We summarize how well the traditional trade-off and pecking order approaches explain these sources of variation and highlight their empirical shortcomings. We review recent research that attempts to address these shortcomings, much of which follows seven broad themes: (*a*) Important variables have been mismeasured in empirical tests, (*b*) the impact of leverage on nonfinancial stakeholders is important, (*c*) the supply side of capital affects corporate capital structure, (*d*) richer features of financial contracts have been underresearched, (*e*) value effects due to capital structure appear to be modest over wide ranges of leverage, (*f*) estimates of leverage adjustment speeds are biased, and (*g*) capital structure dynamics have not been adequately considered. Much progress has been made in addressing these issues, some of which has led to the study of an expanded range of capital structure topics, including debt maturity, loan and covenant characteristics, collateral effects, and alternative financing sources such as leasing and credit lines. We conclude by summarizing unanswered questions and areas for future research.

1. INTRODUCTION

This article reviews recent empirical capital structure research. Much of the research since the seminal work of Modigliani & Miller (1958) has focused on testing the implications of two traditional views of capital structure: the static trade-off model, in which firms form a leverage target that optimally balances various costs (e.g., financial distress costs, stockholder-bondholder agency conflicts) and benefits (e.g., tax savings, mitigated manager-shareholder agency costs) of debt, and the pecking order of Myers & Majluf (1984), in which firms follow a financing hierarchy designed to minimize adverse selection costs of security issuance. Empirically, these theories have experienced both successes and challenges. Each view succeeds in explaining several broad patterns in observed capital structures, such as the association between leverage and various firm characteristics and the aggregate use of different sources of capital. However, neither view has succeeded in explaining much of the observed heterogeneity in capital structures, leverage changes, or security issuance decisions. In Section 2, we provide an overview of some empirical properties of corporate capital structure to highlight these successes and failures.

Researchers have recently taken several approaches to address the shortcomings of the traditional models. These explanations, although not mutually exclusive, differ in their assumptions and implications about the nature of the traditional models' struggles. In some, the problem lies not in the models themselves, but in our empirical measures of leverage and proxies for firm characteristics, or biased estimates of model parameters. Other researchers suggest that although the general framework of a given model is appropriate, the list of relevant market frictions is incomplete. Still others suggest that the correct frictions have been identified, but the implications of those frictions for financial policies are incomplete without additional insights from optimal contracting or dynamic considerations. Another possible explanation is that perhaps the impact of modest leverage changes on firm value is small, resulting in neutral mutations in observed data. These explanations of the inadequate performance of the traditional capital structure models can be broadly grouped into the following seven categories:[1]

1. Important dependent and explanatory variables have been mismeasured.
2. The impact of leverage on nonfinancial stakeholders is important.
3. The supply side of capital affects corporate capital structures.
4. Richer features of financial contracts should be considered and should add new dimensions to study.
5. Value effects due to capital structure variation are modest over wide ranges of leverage.
6. Estimates of leverage adjustment speeds are biased.
7. The implications of capital structure dynamics have not been adequately considered.

Note that the first five of these, which we review in Section 3, are focused primarily (though not exclusively) on explaining cross-sectional capital structure variation, whereas the last two, reviewed in Section 4, focus on variation within firms. Although much of our discussion focuses on efforts to explain leverage ratios or the debt-equity choice, in Section 3 we also review the proliferation of new research into the rich capital structure

[1]An additional line of research not reviewed here focuses on the interaction between financial policy and product market outcomes. For an excellent recent review, see Parsons & Titman (2008a).

texture that emanates from item 5, such as debt maturity, collateral effects, covenants, and credit lines.

Although we begin by reviewing the empirical relevance of traditional capital structure views, we note that there may not be much incremental knowledge gained by additional large sample tests of the pecking order versus the trade-off theory. Any decision that a company makes can be viewed as trading off some costs and benefits. A broad enough interpretation of the trade-off theory may then be impossible to reject. In our view, the real question is which economic forces are most important to capital structure choices. The sections that follow review the directions the field is taking toward identifying these factors.

Further, there likely is not any one-size-fits-all capital structure theory. For example, the pecking order was not designed as a general theory to explain capital structure for all firms in all settings; rather, the original theory is geared toward mature, low-growth firms. More generally, a given market friction may be a first-order concern for some types of firms, but of little relevance to others. Given the plethora of forces and issues that capital structure research can investigate, challenges going forward include how to discern which issues are first-order important versus secondary, and whether to study relations that hold relatively weakly in broad panels of data versus holding strongly in very narrow samples. We comment further on these issues in the conclusion.

2. LEVERAGE VARIATION AND THE LIMITATIONS OF TRADITIONAL MODELS

A primary goal of capital structure research is to explain the heterogeneity in observed capital structures. In this section, we highlight the successes and failures of traditional models in explaining this variation. We look first at the directional associations between leverage and firm characteristics and then at the ability of standard measures of the severity of market frictions to explain the various components of leverage variation.

2.1. Leverage and Firm Characteristics

Table 1 (panel A) examines differences in firm characteristics, conditional on the degree of financial leverage. (The data are taken from the Compustat annual files from 1974 through 2009. See table headers for a more complete sample description.) Several features are evident. First, firms vary widely in their use of leverage. Average book leverage ranges from 1% in the lowest leverage quintile (11% of sample firms have no debt) to 63% in the highest quintile. Second, firms with very low levels of leverage differ in fundamental ways from firms with high leverage. For example (as many previous authors have documented), high leverage companies are significantly larger and older; have more tangible assets, lower market-to-book ratios, and less volatile earnings; and are less R&D intensive. Third, the relation between leverage and many of these variables is nonlinear. Specifically, firms with very high leverage (quintile 5) are smaller and younger and have higher market-to-book ratios than firms with moderately high leverage. Although this is partly influenced by the presence of distressed firms in the highest leverage quintile, **Figure 1** indicates that several of these nonlinearities remain even after removing distressed firms.

Table 1 Firm characteristics and capital structure[a]

Panel A: Sorting by book debt / assets					
	Book leverage quintile				
	1	2	3	4	5
Book leverage	0.01	0.10	0.23	0.36	0.63
Maturity (%> 3 years)	0.20	0.39	0.52	0.56	0.57
Size (book assets $mm)	406	1,486	1,979	1,888	1,153
Age (years in Compustat)	8.26	12.00	14.38	13.21	9.50
Profitability (op. income/A)	0.06	0.11	0.12	0.12	0.09
Tangibility (PPE/A)	0.21	0.30	0.36	0.41	0.41
Market assets/book assets	2.51	1.74	1.44	1.35	1.45
Z-score	1.43	2.13	2.20	1.93	1.13
R&D/sales	0.36	0.14	0.06	0.04	0.08
Earnings volatility	0.09	0.06	0.05	0.05	0.06
Marginal tax rate	0.28	0.32	0.34	0.33	0.30
% dividend payers	0.27	0.45	0.53	0.49	0.27
Dividend yield (%)	1.02	1.52	1.91	1.80	1.30
Leases/assets	0.08	0.09	0.09	0.09	0.10
Panel B: Sorting by debt maturity					
	Maturity quintile				
	1	2	3	4	5
Book leverage	0.20	0.28	0.31	0.33	0.39
Maturity (%> 3 years)	0.01	0.23	0.52	0.73	0.92
Size (book assets $mm)	313	1,483	2,047	2,161	1,627
Age (years in Compustat)	8.71	11.02	14.23	15.82	14.33
Profitability (op. income/A)	0.06	0.11	0.13	0.14	0.12
Tangibility (PPE/A)	0.26	0.31	0.37	0.42	0.41
Market assets/book assets	1.91	1.54	1.39	1.33	1.59
Z-score	1.34	2.09	2.26	2.23	1.80
R&D/sales	0.22	0.08	0.04	0.03	0.08
Earnings volatility	0.08	0.06	0.05	0.04	0.05
Marginal tax rate	0.26	0.32	0.35	0.36	0.33
% dividend payers	0.22	0.37	0.52	0.59	0.47

(*Continued*)

Table 1 (*Continued*)

Panel B: Sorting by debt maturity					
	Maturity quintile				
Dividend yield (%)	0.92	1.22	1.83	2.21	1.75
Leases/assets	0.09	0.10	0.10	0.10	0.08
Panel C: Sorting by lease % of fixed commitments					
	Lease % quintile				
	1	2	3	4	5
Book leverage	0.37	0.43	0.33	0.24	0.07
Maturity (%> 3 years)	0.58	0.64	0.57	0.44	0.13
Size (book assets $mm)	1,631	2,546	1,993	908	262
Age (years in Compustat)	11.02	13.24	14.36	11.50	7.82
Profitability (op. income/A)	0.12	0.12	0.12	0.11	0.05
Tangibility (PPE/A)	0.49	0.41	0.33	0.31	0.20
Market assets/book assets	1.38	1.49	1.46	1.58	2.43
Z-score	1.64	1.52	2.03	2.24	1.34
R&D/sales	0.03	0.07	0.07	0.12	0.36
Earnings volatility	0.05	0.05	0.05	0.06	0.10
Marginal tax rate	0.34	0.32	0.33	0.33	0.27
% dividend payers	0.53	0.45	0.47	0.38	0.20
Dividend yield (%)	2.44	1.64	1.67	1.30	0.75
Leases/assets	0.00	0.03	0.07	0.18	0.13
Panel D: Sorting by total leverage: (debt + leases) / assets					
	Total leverage quintile				
	1	2	3	4	5
Book leverage	0.07	0.14	0.23	0.33	0.53
Maturity (%>3 years)	0.16	0.34	0.49	0.59	0.64
Size (book assets $mm)	814	1,429	1,988	1,723	936
Age (years in Compustat)	9.05	10.85	13.64	13.44	10.07
Profitability (op. income/A)	0.07	0.09	0.11	0.11	0.10
Tangibility (PPE/A)	0.26	0.26	0.34	0.40	0.40
Market assets/book assets	2.17	1.92	1.55	1.42	1.52
Z-score	1.57	1.82	1.97	1.90	1.59

(*Continued*)

Table 1 (*Continued*)

Panel D: Sorting by total leverage: (debt + leases) / assets					
	Total leverage quintile				
R&D/Sales	0.25	0.20	0.11	0.06	0.09
Earnings volatility	0.08	0.07	0.06	0.05	0.06
Marginal tax rate	0.29	0.31	0.33	0.33	0.31
% Dividend payers	0.34	0.38	0.50	0.49	0.28
Dividend yield (%)	1.39	1.33	1.80	1.79	1.22
Leases/assets	0.02	0.06	0.07	0.09	0.19

Panel E: Sorting by total liabilities / assets					
	Total liabilities quintile				
	1	2	3	4	5
Book leverage	0.03	0.13	0.24	0.34	0.54
Maturity (%>3 years)	0.27	0.42	0.52	0.56	0.53
Size (book assets $mm)	285	794	1,679	2,081	1,898
Age (years in Compustat)	7.54	11.27	13.53	13.76	10.89
Profitability (op. income/A)	0.06	0.12	0.12	0.11	0.07
Tangibility (PPE/A)	0.25	0.32	0.37	0.40	0.35
Market assets/book assets	2.44	1.76	1.46	1.36	1.51
Z-score	1.39	2.13	2.17	2.00	1.14
R&D/sales	0.40	0.12	0.06	0.05	0.09
Earnings volatility	0.09	0.07	0.05	0.05	0.06
Marginal tax rate	0.29	0.33	0.34	0.34	0.28
% dividend payers	0.26	0.43	0.52	0.51	0.27
Dividend yield (%)	1.06	1.54	1.87	1.86	1.18
Leases/assets	0.06	0.09	0.09	0.09	0.11

[a]The sample consists of firms in the annual Compustat file over the period 1974–2009, excluding utility and financial firms, government entities, and firms with total book assets less than $10 million. Firm-year observations are first sorted into quintiles based on book leverage (panel A), debt maturity (panel B), lease usage (panel C), total leverage (panel D), or total liabilities (panel E). Maturity is measured as the percent of debt maturing in more than three years. Lease use is measured by the sum of operating and capital lease values scaled by total fixed claims (sum of operating leases, capital leases, and other long-term debt). Operating lease value is estimated as the present value (using a 10% discount rate) of current year rental expense plus rental commitments over the next five years, as in Graham et al. (1998). Total leverage is defined as the sum of debt plus leases, scaled by book assets. For each quintile we report the mean of the following firm characteristics: firm size, defined as book assets in millions of 1992 dollars; asset tangibility, defined as PPE/assets; profitability, defined as operating income/assets; the ratio of the market value of assets to book value; modified Altman's Z-score, defined as [3.3*operating income + sales + 1.4*retained earnings + 1.2*(current assets − current liabilities)], all scaled by assets; the ratio of research and development expenses to sales; earnings volatility, defined as the standard deviation of operating income/assets over the last 10 years.

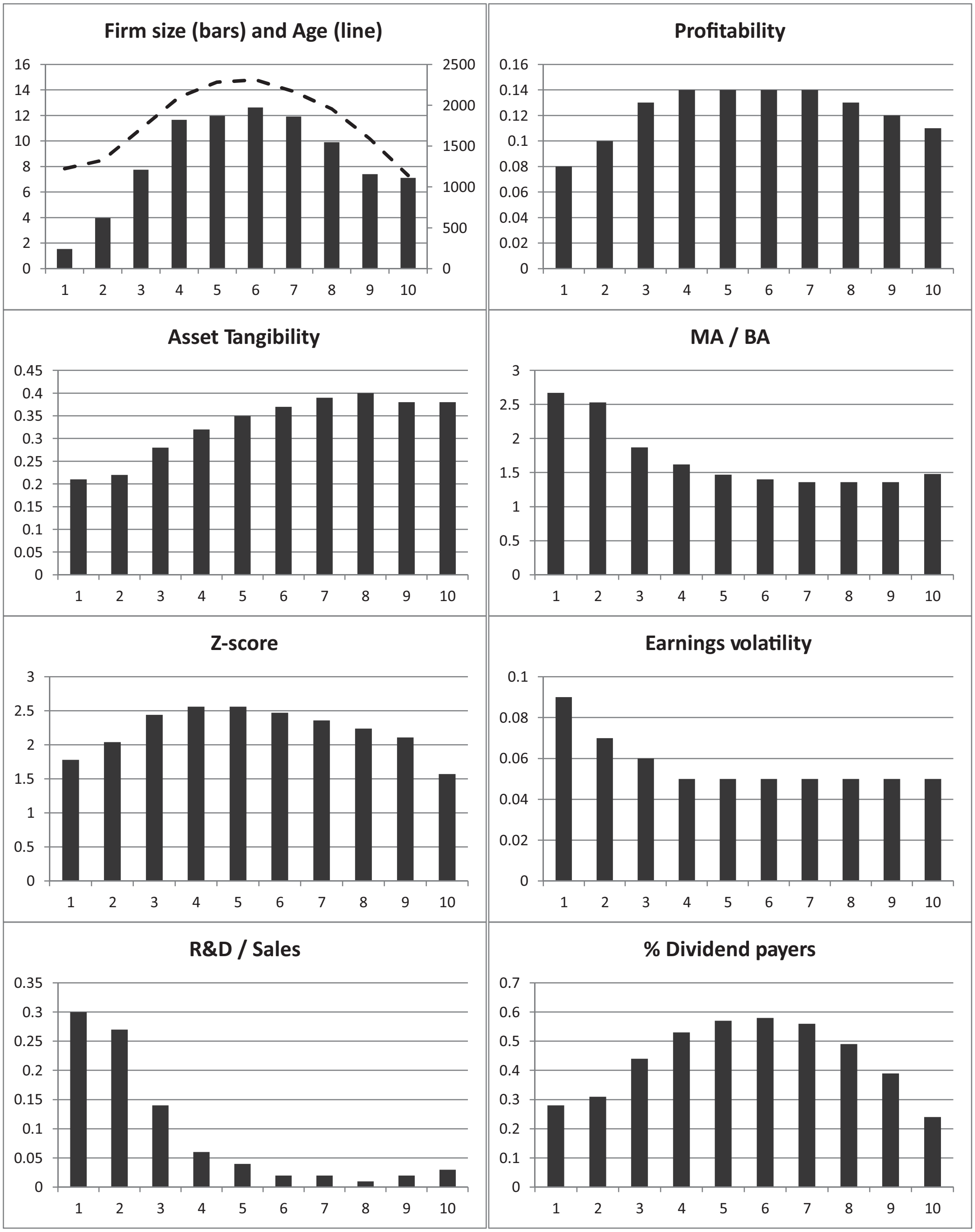

Figure 1

Firm characteristics across leverage (book debt/assets) deciles. The sample consists of firms in the annual Compustat file over the period 1974–2009, excluding utility and financial firms, government entities, and firms with total book assets less than $10 million. Firm years with Altman's Z-score less than 1.81 are excluded, where Z-score is computed as [3.3* operating income + sales + 1.4* retained earnings + 1.2* (current assets − current liabilities)] / Assets + 0.6* Market Equity/Total Liabilities.

Table 1 also indicates a strong positive correlation between the level of leverage and debt maturity, measured by the percentage of debt maturing in more than three years. Panel B shows how firm characteristics vary conditional on debt maturity (Barclay & Smith 1995). Many of the relationships evident for leverage also hold for maturity. Firms with longer maturity debt are on average larger, older, and more profitable; have more tangible assets and fewer growth opportunities; are less R&D intensive; and have less volatile earnings.

Panel C sorts by the proportion of fixed claims accounted for by leases. Here again we see large differences in characteristics between more and less lease-dependent firms, although these differences are most pronounced when moving from the third to fifth quintiles. Companies that use more leases relative to debt are smaller, younger, less profitable, have higher growth, have fewer tangible assets, and pay fewer dividends. Panels D and E present, respectively, analogous tables when sorting by total leverage (debt plus leases scaled by book assets) and the ratio of total liabilities to assets, an alternative measure of leverage proposed by Welch (2011b). The results are similar to those shown in panel A, though we recognize that deeper analysis (e.g., coefficients in multivariate regressions) might reveal important differences.

2.2. Analysis of Leverage Variation

Leverage ratios and other features of financial structure can vary across industries, across firms within an industry, and within a firm (over time). In **Table 2** we decompose total variation in leverage, debt maturity, and lease usage into these three components. The first two columns report the proportion of leverage variation attributable to each component for book and quasi-market measures of leverage. (Market leverage is defined as the book value of short- and long-term debt divided by the sum of the book value of debt and the market value of equity.) We define industries by four-digit SIC codes. First, we note that, consistent with the findings of Lemmon et al. (2008), leverage varies more cross-sectionally than within firms. For both book and market leverage, roughly 60% of leverage variation is cross-sectional. Of that cross-sectional variation, however, the majority is across firms within a given industry rather than between industries, consistent with the findings of MacKay & Phillips (2005). Within-industry leverage variation is twice as large as between-industry variation for market leverage and three times as large for book leverage.

Panel A of **Figure 2** shows that cross-sectional leverage variation has not been constant over time. The figure plots the total, within-industry, and between-industry standard deviation of leverage by year. The overall cross-sectional standard deviation has increased by approximately one-third from 1974 to 2009. Further, almost all of this increase has occurred within industries, while the between-industry standard deviation has remained fairly constant.

Columns 3 and 4 of **Table 2** show similar patterns for debt maturity and the use of leases, respectively. For both measures of debt structure, we see that the majority of variation is cross-sectional and there is substantially more variation within industries than between industries. However, leasing varies relatively more across industries and relatively less within firms.

Given these sources of variation, a natural next question to ask is: How well do our proxies for leverage determinants (those examined in **Table 1**) explain variation in leverage along these dimensions? (We note that capital structure theory does not necessarily imply

Table 2 Characteristics of leverage variation[a]

	% of total variation				% of variation explained			
	Book leverage	Market leverage	Maturity	Lease %	Book leverage	Market leverage	Maturity	Lease %
Between industries	14%	20%	14%	26%	20%	29%	27%	30%
Within industries	44%	42%	42%	40%	15%	20%	15%	14%
Within firm	42%	38%	44%	35%	6%	11%	2%	4%

[a]The sample consists of firms in the annual Compustat file over the period 1974–2009, excluding utility and financial firms, government entities, and firms with total book assets less than \$10 million. We further exclude firms with fewer than two observations and industries with fewer than two firms. The first four columns report the proportion of total variation in book leverage (column 1), market leverage (column 2), the percent of debt maturing in more than three years (column 3), and operating and capital leases as a percent of fixed commitments (column 4) attributable to each source. Variation from each source is measured as follows:

$$\begin{aligned}\sum_i\sum_j\sum_t\left(L_{ijt}-\bar{\bar{L}}\right)^2 &= \sum_i\sum_j\sum_t\left[\left(L_{ijt}-\bar{L}_{ij.}\right)+\left(\bar{L}_{ij.}-\bar{\bar{L}}_{.j.}\right)+\left(\bar{\bar{L}}_{.j.}-\bar{\bar{L}}\right)\right]^2\\ &= \sum_i\sum_j\sum_t\left(L_{ijt}-\bar{L}_{ij.}\right)^2 \quad \text{within-firm}\\ &+\sum_i\sum_j\sum_t\left(\bar{L}_{ij.}-\bar{\bar{L}}_{.j.}\right)^2 \quad \text{within-industry}\\ &+\sum_i\sum_j\sum_t\left(\bar{\bar{L}}_{.j.}-\bar{\bar{L}}\right)^2 \quad \text{between industries,}\end{aligned} \tag{1}$$

where $\bar{L}_{ij.}$ is the within-firm mean for firm i, $\bar{\bar{L}}_{.j.}$ is the industry mean for industry j, and $\bar{\bar{L}}$ the grand mean. The last four columns show the percent of each source of variation that is explained by the following covariates: firm size, defined as log of book assets; asset tangibility, defined as PPE / assets; profitability, defined as operating income / assets; the ratio of the market value of assets to book value; modified Altman's Z-score, defined as [3.3*operating income + sales + 1.4*retained earnings + 1.2*(current assets − current liabilities)], all scaled by assets; and the ratio of research and development expenses to sales. Explained variation is based on estimation of Equations 2 through 4 as described in Section 2.2 of the text.

that leverage is a simple linear function of these variables. However, this exercise gives an indication of the extent to which commonly used proxies for market frictions capture the relevant inputs to capital structure choices.) We estimate the proportion of within-firm leverage, maturity, or leasing variation explained by these determinants by estimating the following regression:

$$L_{ijt} = \alpha + \beta X_{ijt} + \rho_i + \epsilon_{ijt}. \tag{2}$$

We report the adjusted R^2 after partialling out the variation explained by firm fixed effects (ρ_i). Similarly, we measure the proportion of across-industry variation explained by estimating

$$\bar{L}_{.jt} = \alpha + \beta \bar{X}_{.jt} + \gamma_t + \epsilon_{jt} \tag{3}$$

and report the adjusted R^2 after partialling out year fixed effects. Finally, we measure the proportion of within-industry variation explained by estimating year-by-year cross-sectional regressions of the form

$$L_{ij} = \alpha + \beta X_{ij} + \eta_j + \epsilon_{ij}. \tag{4}$$

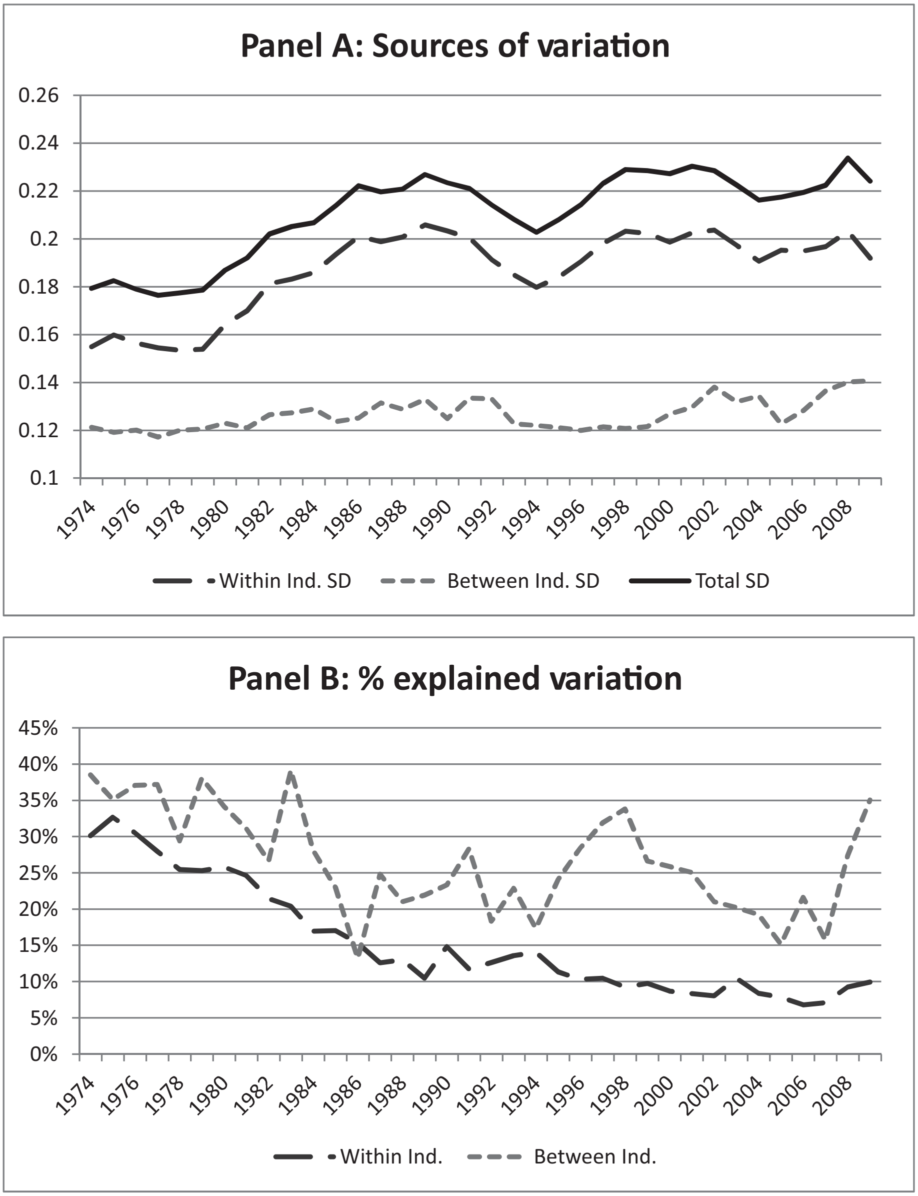

Figure 2

Leverage variation through time. The sample consists of firms in the annual Compustat file over the period 1974–2009, excluding utility and financial firms, government entities, and firms with total book assets less than \$10 million. The solid line in panel A displays the cross-sectional standard deviation in book leverage ratios (defined as the sum of short-term and long-term debt divided by total assets) for each year. The long-dash line displays the within-industry standard deviation, defined as $\sqrt{\frac{\sum_i \sum_j \left(L_{ij} - \bar{L}.j\right)^2}{N-1}}$. The dotted line displays the between-industry standard deviation, defined as the standard deviation of the industry average leverage ratios. Industry is defined by four-digit SIC codes. In panel B, the long-dash line displays the within-industry R^2 from estimating Equation 4 each year. The dotted line displays the between-industry R^2 from estimating Equation 3 each year.

For each year, we take the adjusted R^2 after partialling out industry fixed effects and average these R^2s across years.

The results in columns 5 and 6 of **Table 2** show that the standard variables are least effective at explaining within-firm debt ratio variation, explaining only 6% (11%) of the within-firm variation in book (market) leverage. Columns 7 and 8 show that these proxies are even less successful at explaining within-firm changes in debt maturity and leasing. This is consistent with the findings of Welch (2004), who concludes that despite frequent security issuance activity, year-by-year changes in leverage ratios are difficult to reconcile with capital structure theories. Standard proxies are more successful in explaining cross-sectional leverage variation, and explain relatively more between-industry variation (20% and 29% for book and market leverage, respectively) than within-industry variation (15% and 20%). Again, the same pattern holds for debt structure. Yet, even where the standard proxies perform best, the majority of leverage variation remains unexplained. For example, in **Figure 1** although there are large differences in asset tangibility (net plant, property, and equipment scaled by assets) between firms in the lowest leverage decile and those in the middle decile, there is little variation in average tangibility across deciles 6 through 10. Similar patterns hold for other characteristics, such as market-to-book, R&D, and earnings volatility.

Finally, we note that not only do existing determinants struggle to explain leverage variation, their explanatory power has declined over time. In panel B of **Figure 2**, we report the proportion of explained variation within and between industries by year. Combined with panel A, we see that, although within-industry variation has increased over time, our ability to explain that variation has decreased. Within-industry R^2s for book leverage have fallen from roughly 30% in the mid-1970s to less than 10% in the most recent decade. Much of this decline occurred during the 1980s. Between-industry R^2s have also declined somewhat, especially during the 1980s, and are markedly more volatile.

Taken together, we summarize the stylized facts for leverage, maturity, and lease intensity as follows:

1. There is more cross-sectional variation than within-firm variation.
2. Most of the cross-sectional variation is within industries as opposed to across industries.
3. Within-industry variation has increased over time.
4. Standard proxies best explain variation across industries, but struggle to explain variation within firms.
5. The ability of standard proxies to explain leverage variation has declined over time, particularly for within-industry variation.

2.3. What Do Traditional Theories Explain?

The analyses above highlight the empirical successes and failures of traditional theories of capital structure. Building on the irrelevance results of Modigliani & Miller (1958), the static trade-off suggests that firms choose their capital structures to balance the benefits of debt financing (e.g., corporate tax savings and mitigation of agency conflicts between managers and shareholders) with the direct and indirect costs of financial distress. Several cross-sectional patterns in leverage are broadly consistent with this view. [See, for example, studies by Bradley et al. (1984), Titman & Wessels (1988), Rajan & Zingales (1995), and Fama & French (2002) and excellent reviews by Harris & Raviv (1991), Frank & Goyal (2008), and Parsons & Titman (2008b).]

For example, if large firms are more stable, they likely face lower bankruptcy probabilities and thus have higher optimal leverage. And if tangible assets are easier to recover in default than intangible assets, leverage should be positively correlated with asset tangibility and negatively correlated with R&D intensiveness. In terms of investment opportunities, low-growth firms are likely more exposed to agency conflicts between managers and shareholders, whereas firms with valuable growth options are more exposed to debt overhang concerns. We would thus expect leverage to be negatively associated with the market-to-book ratio. Further, Graham (1996a) and Mackie-Mason (1990) show that high marginal tax rate firms are more likely to issue debt. Focusing on within-firm variation, the trade-off view is that deviations from optimal leverage are costly and should be corrected. Studies such as Jalilvand & Harris (1984) present evidence that leverage ratios mean revert, consistent with firms managing leverage toward a target.

Thus, directionally, many of the observed cross-sectional and within-firm patterns in leverage are consistent with traditional trade-off predictions. However, there are important shortcomings. First, as several authors point out, the negative relation between profitability and leverage appears inconsistent with the trade-off model because, all else equal, more profitable firms should more highly value the tax-shield benefits of debt. Related, many firms have very low (or zero) leverage despite facing heavy tax burdens and apparently low distress risk (Graham 2000). Second, although directional trade-off predictions are consistent with broad leverage patterns, they explain relatively little of the observed capital structure variation. Lemmon et al. (2008) argue that much of the remaining variation is firm specific and time invariant (though, as we show in **Table 2**, there remains substantial unexplained within-firm variation). Third, although studies estimating partial-adjustment models (e.g., Jalilvand & Harris 1984, Auerbach 1985) report statistically significant mean-reversion parameters, recent research (e.g., Fama & French 2002, Baker & Wurgler 2002, Welch 2004, Iliev & Welch 2010) suggests that the rate of reversion to target is too slow to be considered a first-order policy determinant. In light of this evidence, Myers (1993 p. 84) suggests, "[The static trade-off model] may be a weak guide to average behavior. It is not much help in understanding any given firm's decisions."

A traditional alternative to the trade-off view comes from the pecking order of Myers & Majluf (1984) and Myers (1984). Although not a distinct framework from the trade-off view (all economic choices involve trade-offs between costs and benefits), the models differ in their views of which market frictions are most relevant. The pecking order view suggests that the adverse selection costs of issuing equity are large enough to render other costs and benefits of debt and equity second order. This implies financial slack is valuable and predicts a financing hierarchy in which mature firms with limited growth prospects finance investments first out of internal funds, then with debt, and issue equity only as a last resort.[2] The promise of this view lies in its consistency with two empirical regularities: (*a*) There is a significant negative market reaction to the announcement of seasoned equity issues; and (*b*) in aggregate, firms fund the majority of investments with retained earnings, whereas aggregate net equity issues are often small or even negative.

[2]Other frictions, such as transaction costs, taxes, agency costs, and managerial optimism can also generate this hierarchy. See Stiglitz (1973), Heaton (2002), and Myers (2003). Similar predictions can also be generated from full-information models if investment is the first-order decision and payout is smoothed, as in Lambrecht & Myers (2010).

At the micro level, studies by Shyam-Sunder & Myers (1999) and Helwege & Liang (1996) have shown a strong correlation between a firm's financing deficit (a proxy for the need for external funding) and the issuance/retirement of debt. [Chirinko & Singha (2000) raise concerns over the power of financing-deficit regressions to distinguish among alternative financing motives.] Frank & Goyal (2003) report very different results when applying the tests of Shyam-Sunder & Myers to a broader sample. Specifically, smaller and younger firms fill their financing deficits largely with equity. Similarly, Fama & French (2005) report that equity issues are common, especially among small and high-growth firms. Although such firms likely face greater information asymmetry, Lemmon & Zender (2010) point out that these findings are not necessarily inconsistent with the pecking order for two reasons. First, high-growth firms may be constrained by limited debt capacity (although this suggests a role for trade-off forces). Second, Myers & Majluf (1984) demonstrate that the pecking order is most likely to be relevant for firms for which the value of growth opportunities is low relative to assets in place. However, Leary & Roberts (2010) find that the pecking order struggles to correctly predict issuance decisions, even among subsamples where the theory is most expected to hold. Overall, although the pecking order may be a useful "conditional theory" (Myers 2001), as with the trade-off view, it leaves many financing decisions unexplained.

Thus, although the traditional views each contain "elements of truth that help explain some aspects of financing decisions" (Fama & French 2005, p. 581), neither, by itself, is able to account for the rich diversity in observed financial structures. It is against this backdrop that we turn our review to recent advances in capital structure research that offer explanations for these shortcomings and explore related issues.

3. WHY HAVE TRADITIONAL CAPITAL STRUCTURE MODELS STRUGGLED?

The previous section documents that extant research leaves much of the variation in corporate debt policies unexplained. In this section, we review the primary approaches the recent literature has taken to address this shortcoming.

3.1. Variable Mismeasurement

In this section we summarize research related to the mismeasurement of the dependent variable, leverage. We also review literature that studies mismeasurement of distress costs and tax shields.

3.1.1. Leverage. Several authors have suggested that empirical capital structure inference is clouded by mismeasurement of the dependent variable itself: leverage. Welch (2011b) points out that standard measures of leverage exclude non-debt liabilities from the numerator. Thus, all else equal, a firm with more nonfinancial liabilities appears less levered (see panel E of **Table 1** for analysis conditioning on total liabilities, one measure that Welch suggests to avoid this problem).

Some papers consider the effect of leasing on the dependent variable. Graham et al. (1998) include the interest portion of operating leases in their measure of indebtedness and in their table III capitalize operating leases into a stock value. Following suit, Rampini &

Viswanathan (2010a) and Rauh & Sufi (2010b) suggest including the capitalized value of operating leases in measures of debt (see panel D). Cornaggia et al. (2009) document that the role of leases has increased in time, and that increased operating leases appear to substitute for debt usage. Consequently, the potential relevance of measuring total debt as the sum of capitalized leases and debt appears to be growing in importance.[3] Rampini & Viswanathan (2010a) show that average "debt plus leasing" ratios are relatively constant across firm size deciles, whereas debt ratios (without adding leases) are positively related to size, suggesting that firm size affects the debt structure but not the total amount of leverage a firm truly chooses. (Our analysis in panel C of **Table 1** indicates that the proportion of fixed claims from leasing decreases monotonically with size.) Rauh & Sufi (2010b) also include lease values in leverage, and find that this increases the explanatory power of industry average leverage for firm *i* leverage by approximately 20% (R^2 increases from 0.20 to 0.24).

3.1.2. Distress costs.

One vexing problem for the tax-bankruptcy cost trade-off literature is that the probability of distress as measured by historic default occurrence is small. On the basis of these probabilities, the expected cost of distress appears to be much smaller than the apparently large corporate tax benefits that could be achieved by using more debt (Miller 1977, Graham 2000), implying that observed debt ratios are smaller than the optimal debt implied by some traditional static trade-off models. Almeida & Philippon (2007) emphasize that distress occurs in bad times, when the utility of a dollar is high. Thus, one should not use standard probabilities to calculate expected distress costs. Instead, the authors deduce risk-adjusted (i.e., risk-neutral) default probabilities from market data on corporate bond spreads. These probabilities of default imply that the risk-adjusted present value expected cost of default for BBB-rated bonds is approximately 4.5% of firm value, much higher than the 1.4% implied by standard probabilities. This 4.5% is also close in magnitude to extant measures of the benefits of debt [e.g., net of a rough measure of personal tax costs (Graham 2000)]. Thus, measured in this way, the expected cost of distress may be large enough to offset on average the expected benefits of debt, and therefore on average corporate debt choices may be close to the ex ante optimum implied by the trade-off model.[4] (We note that though Almeida & Philippon's approach helps explain the average cost/benefit trade-off, it does not address cross-sectional issues about why some firms (e.g., profitable firms) appear to use less debt than the trade-off model might imply.) Molina (2005) also argues that distress probabilities are underestimated (in his view, due to omitted variable bias). To correct this bias, Molina proposes using marginal tax rates and past market valuations as instrumental variables for leverage. Under Molina's assumption that these instruments are unrelated to credit ratings (but for their effect on leverage), he estimates a much higher expected probability of distress, again offering a possible solution to the underleverage puzzle.

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[3]The Financial Accounting Standards Board is debating whether operating and capital leases should be combined and presented on the balance sheet. (Currently, operating leases are off balance sheet but discussed in financial footnotes.) If this accounting change goes through, it may affect whether future empiricists can identify separate capital and operating leasing behaviors.

[4]Elkamhi et al. (2009) argue that Almeda and Phillipon's 4.5% calculation lumps together effects of negative economic shocks and default costs. Using the Leland-Toft (1996) structural model to separate out the effects of economic shocks, they argue that ex ante expected default costs are less than 1%, much smaller than expected tax benefits.

3.1.3. Tax shields. It is possible that standard measures of tax benefits of incremental interest deductions are overstated. Following in the tradition of DeAngelo & Masulis (1980), several papers demonstrate that there are substantial non-debt tax shields that are missed by research based solely on standard financial statement data. Graham & Tucker (2006) gather data from 44 tax shelter legal filings and find that the annual deduction due to shelters is huge, averaging 9% of asset value. Given such large off-balance-sheet deductions, these firms would not find incremental debt interest deductions very valuable, and the authors document that these companies reduced their debt ratios by approximately 800 basis points during the years of shelter activity. Shivdasani & Stefanescu (2010) find that, although they are somewhat smaller in magnitude, pension contributions that can be deducted from taxable income are roughly one-third of debt interest deductions. This implies that standard debt ratio measures are understated for defined benefit firms and also that defined benefit deductions reduce the incentive to use traditional debt tax shields. Graham et al. (2004) find a similar result in relation to deductions occurring due to executive stock option exercises. The implication of these papers is that researchers who do not incorporate deductions from off-balance-sheet activity such as tax shelters and pensions may incorrectly conclude that a company uses too few interest deductions. In these last two papers, however, even after these novel deductions are considered, incremental tax benefits still appear to be fairly large.

Huizinga et al. (2008) point to another issue, namely that multinational companies face international tax incentives, whereas most research takes the perspective of a domestic-only firm. Examining data from 32 European countries from 1994 to 2003, the authors find that the usual tax incentive (to use more debt in a country where firms face a higher income tax rate) has moderate effects: A 10% increase in the marginal tax rate increases debt usage by approximately 1.8%. Somewhat more important is shifting debt across subsidiaries within a multinational firm in response to tax rate variation across the countries in which those subsidiaries operate: A 10% increase in the tax rate in one country is estimated to lead to a 2.4% increase in debt in the subsidiary operating in that country (relative to a subsidiary that did not face a tax increase).

3.2. Nonfinancial Stakeholders

Traditional capital structure research focuses on the relationship between the firm and its financial claimants, without addressing employees or other stakeholders. Recent work shows how the incentive effects of capital structure can affect contracting between the firm and nonfinancial stakeholders, in particular, employees, customers, and suppliers.

3.2.1. Suppliers and customers. Titman & Wessels (1988) argue that the indirect costs of distress can be high when distress to a given firm would bring about difficulties for its customers (who are hesitant to purchase from a company that might default and not be around to service the product) or suppliers (who might not supply a product to a firm in or near distress). These issues are heightened for durable goods producers because these are the types of goods for which future service is important.

Banerjee et al. (2008) use customer/supplier data from the Compustat Business Information File (which runs only through 1999) and find that companies use less debt when their suppliers are "dedicated" (e.g., a supplier that sells much of its output to one customer). This behavior is consistent with customers considering their own financial distress risk as a cost to the supplier (perhaps because dedicated suppliers will attempt to charge high-debt customers more). The same works in reverse, with suppliers using less debt when their customers are dedicated to one or a few suppliers. In both cases, the results are strongest in durable goods markets. Thus, Banerjee et al. (2008) provide a deeper empirical explanation of Titman & Wessels's finding. In a related paper, Kale & Shahrur (2007) find that less debt is used by companies that have relationship-specific investments (e.g., strategic alliances and joint ventures) with suppliers and customers.

3.2.2. Employees and risk. Leverage also increases risk for another important stakeholder: employees, who are exposed to unemployment risk in the event of bankruptcy. This (indirect) cost of financial distress is ultimately borne by the company in the form of higher wages (Berk et al. 2010) and thus discourages the use of debt in a trade-off sense. Agrawal & Matsa (2010) find evidence consistent with this prediction. They find that when a state (exogenously) increases unemployment insurance benefits, which has the effect of reducing the expected labor risk cost of financial distress, companies increase debt usage. A hypothetical doubling of the unemployment insurance benefit increases debt ratios by approximately 400 basis points. For a BBB firm, the authors estimate that unemployment-related financial risk costs the company approximately 0.57% of firm value.

3.2.3. Labor bargaining. Although the above studies suggest high leverage can make labor contracting more costly, Brander & Lewis (1986) argue that management can use debt as a negotiating tool. For example, firms with a substantial debt load can argue that employees must take a pay cut to help the firm avoid (or emerge from) financial distress.[5] Several recent papers investigate labor negotiations in detail.

Hennessy & Livdan (2009) model optimal debt choice as a trade-off between the bargaining benefits of debt and debt-related supplier disincentives. Their model predicts that leverage should increase with supplier bargaining power (e.g., unionization rates) and decrease with the use of human capital in the production process. Matsa (2010) finds support for the unionization prediction, exploiting exogenous variation that comes from changes in state laws related to union power. He finds that an additional 10% unionization leads to approximately a 100-basis-point increase in debt ratios (as the firm presumably takes on debt as an eventual bargaining device). Matsa implicitly assumes that companies can ex ante use debt (and the probability of financial distress) to negotiate with employees. To document whether this occurs ex post (which would justify the ex ante assumption), Benmelech et al. (2010) investigate whether distressed airlines successfully bargain concessions from employees. They find that airlines are able to wring the largest concessions from the employees who would be hurt the most if an airline went bankrupt (e.g., highly paid pilots who work for airlines with underfunded pensions), consistent with distress playing an important role in labor negotiations in this setting.

[5]An additional implication of Brander & Lewis (1986) and related studies is that capital structure can affect how a firm competes in product markets. Several researchers have shown empirical support for product market effects (e.g., Chevalier 1995; Kovenock & Phillips 1995, 1997; MacKay & Phillips 2005). We limit discussion for space reasons but refer the reader to Parsons & Titman (2008a) for a thorough review.

3.3. Supply Effects

Much of the extant capital structure literature has assumed, consistent with Modigliani & Miller (1958), that capital supply is perfectly elastic, implying that capital structures are determined solely by corporate demand for debt. Several recent studies challenge this notion and suggest that capital market segmentation and supply conditions significantly influence observed financial structures. [We review here recent studies with the most direct implications for corporate capital structure. For a more comprehensive review of the role of supply conditions in corporate finance and investment, see Baker (2009).]

3.3.1. Credit supply. Much of the recent work in this area focuses on segmentation in debt markets between bank-dependent firms and those with access to arms-length lenders. Faulkender & Petersen (2006) use access to public debt markets, proxied by the existence of a credit rating, as a supply shifter. They find that firms with a credit rating have debt ratios significantly higher than those without, even controlling for typical proxies for debt demand. This suggests that firms without bond market access face a different supply schedule than those with. However, a concern is that the existence of a bond rating captures unobservable differences in demand, which Faulkender & Petersen address with instrumental variables, employing proxies for firm visibility and uniqueness as instruments for having a credit rating.

Subsequent studies bolster the identification of this supply effect by studying shocks to the supply curve faced by bank-dependent firms. Sufi (2009b) examines the introduction of ratings for syndicated loans, which he concludes led to increased debt issuance and investment by riskier borrowers. This suggests these ratings were effective in reducing the informational frictions that generate segmentation such as that noted by Faulkender & Petersen. Similarly, Tang (2009) studies the surprise refinement of Moody's credit ratings in 1982 and shows that firms receiving a refinement upgrade added more long-term debt and use more debt relative to equity than firms receiving a downgrade. Leary (2009) studies shocks to banks' access to loanable funds caused by the introduction of negotiable CDs in the early 1960s and the imposition of binding interest rate ceilings in 1966. These loan supply shocks had differential effects on both leverage ratios and the mix of bank versus nonbank debt of small bank-dependent firms relative to large firms. Choi et al. (2010) show that supply effects are also evident in the convertible bond market, using the short-sale ban of fall 2008 as an instrument for the capital supply of convertible bond arbitrage hedge funds.

However, two recent papers demonstrate that supply shocks are not uniformly associated with relative leverage changes. Rice & Strahan (2010) study changes in bank market competition caused by relaxation of interstate branching regulations. They find higher interest rates in states with tighter restrictions on interstate branching, suggesting that decreased competition restricts loan supply. However, they do not find an effect on loan quantities. Lemmon & Roberts (2010) study segmentation based on investment versus speculative-grade bond ratings. Identification comes from the supply shock in the junk bond market precipitated by the collapse of Drexel Burnham Lambert, Inc. and subsequent regulatory changes in 1989. Lemmon & Roberts show that debt issuance and investment of below-investment-grade firms are affected by junk bond supply conditions.[6] However,

[6]This evidence of segmentation based on credit ratings is one possible explanation for the findings of Kisgen (2006, 2009) that firms manage leverage ratios to maintain a given credit rating and of Kisgen & Strahan (2010) that bond yields fall for firms receiving a higher rating from a newly certified agency, relative to their ratings from other agencies.

because speculative-grade firms are unable to substitute toward equity capital, simultaneous declines in debt issuance and investment rates leave leverage ratios relatively unchanged. These results, in combination with those of Rice & Strahan (2010), suggest that the effects of supply conditions on capital structures may depend on the particular segment or economic conditions attending the shock.

3.3.2. Equity market timing. Supply conditions can affect equity issuance motives through either of two channels. The first is that managers attempt to exploit deviations of security prices from fundamental value (Baker et al. 2003, Campello & Graham 2010). Secondly, if adverse selection costs are negatively correlated with market returns, the cost of equity issuance identified by Myers & Majluf (1984) may be lower when prices are high (Bayless & Chaplinsky 1996). Both survey (Graham & Harvey 2001) and archival evidence has shown that the propensity to issue equity (both in absolute terms and relative to debt) is positively correlated with recent past equity returns (Taggart 1977, Marsh 1982, Hovakimian et al. 2001). Whether these patterns can be attributed to equity market supply conditions again depends on our ability to separate supply from demand factors. For example, equity issuance and returns may both be correlated with growth opportunities. Identifying a separate supply effect can be particularly challenging if changes in investor sentiment are correlated with firm fundamentals.

Several types of evidence support the case for a supply channel. First, post-issuance returns and operating performance are unusually low. [See Ritter (2003) and Eckbo et al. (2007) for thorough reviews of the evidence on post-issuance returns. See Loughran & Ritter (1997) for evidence on operating performance.] More recently, Chang et al. (2006) argue that firms with less analyst following are more prone to both mispricing and adverse selection costs. Consistent with supply effects, they find that the equity issues of these firms are more sensitive to equity market conditions than are firms with greater analyst following. Lamont & Stein (2006) argue that aggregate market prices are more likely to reflect mispricing than are individual firm-level prices. Consistent with a mispricing channel, they find that net equity issuance is more sensitive to aggregate stock returns than to firm-level returns. Huang & Ritter (2009) infer the implied equity risk premium from observed prices and analyst EPS (earnings per share) forecasts and show that issuance decisions are highly sensitive to this estimated risk premium. Finally, Baker et al. (2007) present evidence that the willingness of target firm shareholders to passively hold shares received from an acquirer affects both acquirer returns and the choice of payment method (i.e., stock versus cash).

Although supply-driven equity issuance activity is clearly relevant for time-series changes in capital structure, it becomes relevant for cross-sectional leverage ratios only if the capital structure effects of these issuances are persistent. If firms use subsequent security issuance and retirement activity to undo the leverage effects of market timing issuances, they amount only to temporary deviations from optimal capital structure. We return to this issue when we discuss recent evidence on leverage dynamics in Section 4.

3.4. Financial Contracting and Capital Structure

Insights from optimal financial contracting theory broaden our understanding of capital structure beyond that which is provided by the traditional models. [See Roberts & Sufi (2009a) for a thorough review of empirical work in financial contracting.] Traditional models take the types of securities as given and ask whether an optimal mix of these securities enhances firm value. In contrast, this literature starts with an underlying friction (typically an incentive conflict between the manager/owner and investor) and derives the optimal contract(s) that mitigate the effect of the friction.

The resulting empirical questions naturally go beyond just studying leverage ratios and focus on more detailed features and types of financing contracts, such as covenants, maturity, leasing, and the potential for renegotiation.[7] This can help explain the shortcomings of traditional models in several ways. First, if incentive conflicts are controlled by features of debt contracts, there may be little role for the leverage ratio in mitigating agency or information problems. For example, covenants may control incentives more effectively than high leverage (Nini et al. 2009). Second, it helps refine our understanding of the determinants of debt capacity [e.g., Rampini & Viswanathan (2010b) argue that in the face of incentive conflicts, only collateralizable assets can support borrowing capacity]. Third, the contracting literature highlights the fact that not all debt is equivalent, as is often implicitly assumed in constructing leverage ratios. In DeMarzo & Sannikov (2006), for example, firm risk and liquidation values have no effect on total debt capacity but do influence the mix of long-term debt and lines of credit. Empirically, Rauh & Sufi (2010a) examine firms with credit ratings and demonstrate that there is substantial variation in the types of debt financing that firms use, even among firms with similar overall debt ratios.[8] They also show that the correlation between standard leverage determinants and debt levels can be quite different for different types of debt. For example, the negative relation between profitability and leverage is driven primarily by private placements and convertible debt, but reverses sign for bank debt. To the extent that convertible debt is more informationally sensitive than bank debt, this challenges the traditional pecking order interpretation of this relation.

In the rest of this section, we focus on two groups of recent papers coming out of this literature. The first studies the role of asset liquidity and redeployability on the availability, cost, and maturity of debt financing. The second studies the role of covenants and renegotiation.

3.4.1. Collateral and asset redeployability. It has long been known that collateral, as measured by PPE/assets, plays a major role in explaining capital structure (e.g., Graham 1996a). The strong relation is evident and near-monotonic in most panels of **Table 1**, where higher PPE is associated with higher leverage, longer debt maturity, and less leasing as a percentage of fixed obligations. (The PPE effect is nonmonotonic and falls off in panel E, which examines total liabilities over assets.) What is less clear is why the result holds and whether all forms of PPE are equally valuable as collateral. We group papers in this subsection roughly by whether a given paper empirically investigates collateral effects in the context of leverage ratios, cost of finance, debt maturity, or leasing.

[7]There is of course an older literature on these capital structure issues, for example, debt maturity (Myers 1977, Barclay & Smith 1995), covenants (Smith & Warner 1979), leasing (Bautista et al. 1976, Smith & Wakeman 1985). The recent financial contracting literature has rekindled interest in these topics and also introduced a new framework within which to interpret results.

[8]Rauh & Sufi also argue that (rated) companies use multiple sources of debt. Colla et al. (2010) perform similar analysis but also include unrated firms in their sample. They document the intriguing result that most (unrated) firms rely on only one type of debt financing, whether that type be term loans, senior bonds, leases, etc.

Leverage ratios. A central focus of the financial contracting literature is the ability of a lender to seize a borrower's assets in default. Consequently, the redeployability of the asset (i.e., the degree to which the asset can be readily used by other firms) affects the amount and structure of debt that can be borrowed. One key empirical finding is that debt capacity of assets increases when those assets are more redeployable. For example, Campello & Giambona (2010) show that land and buildings, which one could argue are more redeployable than are other forms of PPE, support greater debt usage. In contrast, assets that are not as readily redeployable (e.g., unique machines) have less debt capacity. The authors also find that redeployability is more valuable during periods of tight credit, and (somewhat surprisingly) is important only for financially constrained firms. [Gan (2007) examines the collateral channel effect on corporate policies of the shock to Japanese land values in the early 1990s. She finds that firms with greater land holdings suffered greater reductions in borrowing (and investment) as a result of the reduced liquidity and collateral value of land.] Interestingly, Rauh & Sufi (2010a) find that the positive relation between tangibility and leverage disappears for bank debt, suggesting that bank relationships can substitute for physical collateral.

Though they do not break tangible assets into components (e.g., land/buildings, machinery), Rauh & Sufi (2010b) find that the overall degree of asset tangibility is highly correlated across firms within the same industry (which they measure based on Capital IQ competitor data, rather than SIC codes). They argue that this within-industry similarity of asset tangibility drives their finding that the mean debt ratio of competitors by itself explains 30% of leverage variation. [Recent work by Leary & Roberts (2011) shows evidence for a complementary explanation of the importance of industry leverage, namely that firms are directly influenced by the financing choices of their peers.] Related, two recent papers argue that the amount of debt used should increase when the type of debt used has lower expected cost of distress. In particular, Lemmon et al. (2010) and Korgaonkar & Nini (2010) find that total firm debt increases with the proportion of that debt that is made up by securities backed by safe assets such as accounts receivable.

Financing cost. Benmelech & Bergman (2011) show that the collateral channel can spread the effects of distress from one firm to another. Among airlines, they examine the cost of debt in different tranches, identifying effects based on the degree to which the collateral of a given tranche consists of aircraft models that are also used by other airlines that have encountered distress. The idea is that collateral value decreases, and hence the cost of debt in a tranche increases, when the airplane type is also used by distressed firms. The authors confirm this empirically. Benmelech & Bergman (2009) also study the airline industry, and in particular the secured claims of a given airline. They find more redeployable assets are associated with lower debt costs (as measured by yield spreads), higher credit ratings, and higher loan-to-value ratios.

Debt maturity. Benmelech (2009) defines salability as the combination of asset redeployability and asset liquidity (with the latter being the financial strength of potential third-party users of an asset). A key finding is that debt maturity is affected by collateral characteristics, with more salable assets allowing the firm to use longer-term debt. Benmelech (2009) examines the rolling stock of nineteenth-century railroads and finds that more salable assets (that is, trains with car widths designed to run on standard-gauge tracks) lead to railroad firms using more long-term debt. (Contrary to the research described above, Benmelech does not find a relation between the overall debt ratio and salability.) Focusing more on the liquidity characteristics of collateral, Benmelech et al. (2005) find that more liquid commercial real estate (as measured by the number of potential buyers) leads to more nonrecourse loan contracts and longer maturity debt. [Almeida et al. (2011) document real effects (decreased investment) of debt maturity among firms for which long-term debt matured during the 2007–2009 financial crisis.]

Leasing. Dynamic models can be used to study the important role that collateral plays in leasing. Eisfeldt & Rampini (2009) and Rampini & Viswanathan (2010b) argue that when a borrower is distressed, collateral tied to a lease contract is easier to seize than is collateral tied to secured debt, and therefore leasing increases debt capacity. These models argue that this benefit of leasing is traded off against the cost of separating asset ownership and control in leasing. As a result, more constrained and less profitable firms are more likely to lease. Evidence consistent with these predictions is evident in **Table 1**, panel C (if firm size and asset tangibility are interpreted as inverse measures of financial constraints), though the relation is nonmonotonic. Rampini & Viswanathan (2010a) argue that their model helps explain the "low leverage puzzle": Firms with zero or low leverage are primarily those with few tangible assets, and these firms are significant users of leases. Gavazza (2010) also argues that the expected costs of external finance decrease with asset liquidity. By studying April 2003 aircraft leases, he finds that more liquid assets lead to more operating leasing, shorter term leases (because the lessor demands longer tenor when the asset is less liquid), and lower lease rates.

3.4.2. Constraining managers: covenants and renegotiation. Incentive conflicts often arise as a firm becomes distressed. For example, a manager might like to maintain control of the firm, hoping to right the ship before the firm liquidates, possibly by undertaking risky actions. Lenders, in contrast, would like to take control of the firm before it becomes too distressed. The financial contracting literature derives covenants as a means to address this conflict, giving control to lenders if a firm violates a profitability covenant for instance, or resulting in renegotiation between the borrower and lender at an early stage.

Several recent papers investigate covenants and their effects. Chava et al. (2010) argue that covenants are used to counter managerial agency (e.g., covenants that restrict investment are more prevalent, and covenants that restrict payout or takeovers are less prevalent, when managers are entrenched) and lack of informational transparency (e.g., payout covenants are more common when a firm uses less transparent accounting or when uncertainty about investment is high).

Roberts & Sufi (2009b) find that one-fourth of U.S. public companies violate a debt covenant at some point between 1996 and 2005. Following these violations, one-fourth of lenders reduce the size of the violator's credit facility, and debt ratios of violators decline from approximately 29% to 24%, but only 4% of credit agreements are terminated by the lender. Though these results indicate that covenants matter, the authors state (p. 1,669) that "covenant violations are not responsible for much of the total variation in leverage ratios" (see Section 2 of our review).

Sufi (2009a) studies covenants associated with corporate lines of credit. He finds that credit lines are an important potential source of funding, equaling 16% of total assets. (On average, 6% is drawn from credit lines and would appear as debt on the balance sheet, whereas 10% is undrawn and represents unused debt capacity.[9]) Sufi highlights that access to credit line financing is conditional on corporate performance by documenting that the size of available credit lines shrinks by one-fourth following violation of a covenant. Campello et al. (2011) survey several hundred public and private firms regarding line of credit covenant violations during the 2007–2009 financial crisis. They find that 19% of respondents violated a financial covenant and another 8% nearly violated one. Even in the midst of a crisis, only 9% of violators had all of their credit lines canceled in response, though the majority received unfavorable changes in terms (e.g., higher fees, collateral requirements, or borrowing limits). This suggests that intermediaries are willing to renegotiate to maintain the lending relationship. Overall, the financial consequences of violation were more severe during the credit crisis, but even then covenant violations did not prevent access to credit for most firms. [Chava & Roberts (2008) and Nini et al. (2009) document real effects (decreased investment) following covenant violation.]

Benmelech & Bergman (2008) find that collateral values are important not only for obtaining financing, but also for influencing renegotiation. They find that airlines are better able to renegotiate lease obligations when the collateral behind the lease is poor (and when an airline's financial position is poor).

3.5. Are Value Effects Large Enough to Affect Capital Structure Choices?

In Section 2, we highlighted that several correlations between leverage and firm characteristics are directionally consistent with predictions from traditional trade-off theories, though other relations either are not statistically significant or have the wrong sign. **Table 2** and **Figure 2** highlight that the majority of capital structure variation remains unexplained. In this section, we discuss research that indicates that the contribution to firm value of optimal capital structure choices is moderate for most firms (though large for some firms). If the value effects of capital structure are modest over wide ranges of leverage, this might explain why researchers have struggled to document large, significant capital structure effects. Although large deviations from optimal may be costly, there may be little incentive for companies with moderate leverage to frequently optimize capital structure policy (in ways that are correlated with observable variables).

Two recent papers quantify the net benefit of optimal financial policy and shed some light on the value-importance of capital structure decisions. They both find that the importance of capital structure trade-offs may be modest over wide ranges of leverage choices. van Binsbergen et al. (2010) examine the debt choices of nondistressed, unconstrained firms that appear to make (close to) optimal financing decisions. In equilibrium, these debt choices should occur where the marginal benefit function (directly simulated by the authors) intersects the marginal cost of debt function. The cost function itself is unobserved; however, as the benefit function shifts, it is possible to observe a series of optimal cost/benefit intersection points, and these observed points allow the cost function to be inferred (by statistically connecting the dots provided by the intersection points). The crucial requirement is that the cost function must remain fixed as the benefit function shifts, which the authors accomplish by including control variables designed to hold the cost function ceteris paribus fixed and/or by observing exogenous variation in benefit

[9]Approximately one-third of firms that have zero debt on the balance sheet have an established but completely undrawn line of credit, providing a new wrinkle in the puzzle of zero debt firms.

functions induced by tax regime changes. This approach explicitly provides firm-specific benefit and cost of debt functions. By integrating the area between these functions, the authors estimate the net benefits of optimal financing choice. van Binsbergen et al. (2010) find that the net benefit of optimal financial choice equals approximately 3.5% of asset value averaged across all firms. Net benefits average 6% for firms in the upper half of the net benefit distribution, but only approximately 1% for firms in the lower half of the distribution.

Korteweg (2010) uses a completely different approach and finds similar results. Korteweg generalizes the Modigliani & Miller (1958) beta levering and valuation formulas. By observing how market returns of stocks and bonds vary across firms, conditional on a company's leverage, he infers a 4% net contribution of financing choice to firm value.

This evidence indicates that for perhaps half of public firms, the value contribution of optimal capital structure is modest [see van Binsbergen et al.'s (2010, figure 10) relatively flat value function for leverage ±20% of optimal debt choice], perhaps indicating that many firms will not carefully optimize capital structure each period (in the face of even modest transactions costs). However, it is also the case that far-out-of-equilibrium choices (e.g., using excessive debt) can have disastrous effects. It is also true that for some firms, the optimal financing choice is quite valuable. For example, Guo et al. (2011) show that private equity investments earn abnormal returns of nearly 70% in 192 leveraged buyouts completed between 1990 and 2006, with approximately one-third of that coming from interest tax savings, greater than the one-fourth emanating from operating improvements. Thus, in some cases, choosing a new capital structure is associated with substantial value enhancement. Nonetheless, these papers raise the possibility that the moderate success of the capital structure literature is tied to moderate value effects for a wide variety of capital structure choices.

3.5.1. Does capital structure reflect managers' personal preferences? One potential implication of a flat value function is that capital structures may reflect managers' personal preferences or biases, with little correction by equityholders or the market for corporate control. Several recent studies suggest this could be the case. Bertrand & Schoar (2003) provocatively find that CFO fixed effects (but not CEO effects) are correlated with leverage and interest coverage in their firms. [Finding that CFOs affect capital structure is plausible, given the evidence in Graham et al. (2010) that CFOs play a relatively larger role in decisions in capital structure than in other corporate policies (such as mergers and acquisitions).] The authors identify manager fixed effects when the CFO moves from one company to the other, with the implication that debt policy changes as a new CFO arrives to the firm. Due to data limitations, it is not possible to say whether the CFO forces her capital structure preferences on the firm or the firm decides it wants a new capital structure and therefore hires a CFO whom it knows has worked in a similar capital structure setting in the past.[10]

Graham & Narasimhan (2004) document a capital structure effect based on personal experiences during the Great Depression era. The authors document that debt ratios fell by

[10]Fee et al. (2010) examine exogenous variation in CEO changes, such as unexpected death, which they argue would be easiest to causally interpret in terms of executive fixed effects. They do not find evidence of CEO fixed effects in corporate policies following these exogenous events, leading them to question previous managerial style interpretations.

approximately one-third during the Depression. The more interesting result is that debt ratios remained low at companies as long as their Depression-era president remained in power. Once the Depression-era president left the firm, on average the firm's debt ratio increased back to its pre-Depression level. Malmendier et al. (2011) link several personal CEO traits to corporate financial policy. They also find that CEOs with Depression experience use less external financing. Malmendier et al. also find that overconfident managers (who thus might view their firm as being undervalued) rely more heavily on internal financing. A recent paper by Cronqvist et al. (2010) finds an association between a manager's personal leverage (measured by home mortgage loan-to-value ratio) and corporate leverage.

Related, two recent studies show that risk incentives in CEO compensation contracts significantly impact leverage decisions. Lewellen (2006) uses information about CEO portfolios to estimate the impact of a change in leverage on each CEO's certainty-equivalent wealth, which she empirically links to issuance decisions and leverage. Brockman et al. (2010) similarly find that compensation packages affect the structure of debt financing. In particular, certain (high vega) compensation packages may give managers incentive to take on risk, whereas others (high delta) may discourage risk. The authors find that short-term debt, which can be used to attenuate the incentive to take on risk, is more prevalent in risky (high vega) settings, and less prevalent in low-risk (high delta) settings.

4. EXPLAINING WITHIN-FIRM VARIATION

The previous section described new research that (for the most part) addresses inadequacies of traditional explanations of cross-sectional variation in capital structure. In this section we review deficiencies and recent improvements related to within-firm analysis.

4.1. Mismeasurement of Adjustment Speeds

One potential explanation for the poor explanatory power of traditional trade-off models is that firms are often perturbed away from target leverage. That is, firms' actual leverage may deviate from optimal due, for example, to shocks to asset values or because managers take advantage of short-term market timing opportunities. If so, proxies for optimal leverage determinants will have low explanatory power, both in the cross section and within firm. If firms actively manage leverage toward a target, though, we ought to see evidence of a return to target following such shocks.

However, several authors conclude that firms appear to respond slowly (at best) to deviations between actual and target leverage. For example, Fama & French (2002) estimate a partial-adjustment model of leverage and find the speed of adjustment (SOA), although statistically significant, to be "a snail's pace." Welch (2004) finds that 60% of year-by-year variation in leverage ratios is due to active net issuance activity. However, very little of this variation is explained by proxies for leverage targets and firms do not appear to reverse the mechanical effect of stock returns on leverage. Baker & Wurgler (2002) report that past market timing opportunities, proxied by an external-finance-weighted average of past market-to-book ratios, are strongly negatively correlated with leverage ratios, even controlling for contemporaneous firm characteristics. Further, these effects are highly persistent: The marginal effect of past timing opportunities measured up to year t is still evident in year $t+10$.

All of these results suggest, in different ways, that firms do not appear to actively manage leverage toward a target. Recent research argues that much of this evidence results from mismeasurement of adjustment speeds. Some recent studies focus on bias in estimates of partial-adjustment coefficients (Section 4.1.1). Others argue that partial-adjustment models have weak power to distinguish leverage targeting from other financing motives (Shyam-Sunder & Myers 1999, Chang & Dasgupta 2009). As a result, to infer targeting behavior, other studies examine security issuance choice or the response to specific leverage shocks (Section 4.1.2).

4.1.1. Partial-adjustment models. A common empirical specification of a traditional trade-off model that allows for temporary deviations from target is the partial-adjustment model:

$$\begin{aligned} \Delta L_{it} &= \alpha + \gamma\left(L^*_{it} - L_{it-1}\right) + \epsilon_{it} \quad \text{or} \\ L_{it} &= \alpha + \gamma L^*_{it} + (1-\gamma)L_{it-1} + \epsilon_{it}, \end{aligned} \tag{5}$$

where L^*_{it} is the optimal leverage for firm i in time t, and γ measures the SOA—how much of the gap between actual and target leverage a firm closes in a year. Note that the unobserved optimum L^*_{it} must be specified by the researcher, usually as a linear combination of observable leverage determinants such as those in **Table 2**. However, Lemmon, Roberts, and Zender (LRZ) demonstrate that the estimated SOA is little affected whether one specifies the target as a firm-specific constant or as a function of time-varying characteristics (Lemmon et al. 2008). Likewise, Iliev & Welch (2010) show that most estimators produce similar SOAs whether data are simulated under the assumption of unknown targets or data are simulated with perfectly known targets.

Several authors note that much of the unexplained leverage variation (**Table 2**) is firm specific. LRZ show that adding firm fixed effects to the standard set of leverage determinants more than triples the adjusted R^2. The presence of firm effects in the error makes consistent estimation of the SOA challenging, given that it implies correlation between ϵ_{it} and L_{it-1} in Equation 5. Unfortunately, simply adding fixed effects (or de-meaning variables within firm) does not remove the correlation between the independent variable and the error. Fortunately, the biases from estimating the partial-adjustment model with OLS and fixed effects run in opposite directions, with OLS understating the true adjustment speed and fixed-effects estimation overstating it (Hsiao 2003). This at least allows us to bound the average SOA.[11]

Table 3 summarizes estimated leverage adjustment speeds from recent studies. [All reported adjustment speed estimates are based on book leverage, with the exception of Flannery & Rangan (2006). The estimate from Kayhan & Titman (2007) is an annualized rate based on the five-year rate reported in their paper.] As expected, OLS delivers the lowest estimates, ranging from approximately 10% to 18% per year. Fixed-effects estimates are the highest, close to 40% per year. Several authors have turned to instrumental variables and

[11]However, both Huang & Ritter (2009) and Flannery & Hankins (2010) demonstrate that for subsamples of firms with as few as five observations (the median firm in the industrial CRSP/Compustat universe has only seven years of data), the bounds placed on the SOA by OLS and fixed-effects estimators can be too wide to provide useful information.

Table 3 Comparison of speed of adjustment estimates[a]

	OLS	GMM/IV	Fixed effects	Alternatives
Fama & French (2002)	9%–18%	—	—	—
Kayhan & Titman (2007)	10%	—	—	—
Flannery & Rangan (2006) (mkt. lev.)	13%	34%	38%	—
Lemmon et al. (2008)	17%	25%	39%	—
Huang & Ritter (2009)	—	17%	—	—
Elsas & Florysiak (2010)	—	—	—	26%
Iliev & Welch (2010)	—	—	—	<0%

[a]The table summarizes estimated speeds of adjustment from partial adjustment models of leverage using different estimation techniques. OLS refers to ordinary least squares; GMM/IV refers to generalized method of moments and instrumental variables estimation; fixed effects refers to panel data models with firm fixed effects.

GMM approaches to reduce the bias in these previous sets of estimates. [Flannery & Hankins (2010) compare the performance of various estimators on simulated data sets with features similar to standard corporate data and conclude that Blundell-Bond and the bias-corrected fixed-effects estimator of Kiviet (1995) perform best.] Flannery & Rangan (2006) use IV with the lagged market leverage ratio as an instrument for the lagged book ratio; LRZ employ the system GMM estimator of Blundell & Bond (1998); Huang & Ritter (2009) argue that the long-difference estimator of Hahn et al. (2007) performs better than these alternatives, given the persistence of leverage ratios (low SOA). More recently, Elsas & Florysiak (2010) propose a doubly censored dynamic panel estimator to account for the fractional nature of leverage (i.e., market leverage is bounded between 0 and 1). Note that all the estimates from techniques designed to address the aforementioned bias fall within the 10%–40% range provided by OLS and fixed-effects estimates. However, there remains considerable variation across estimates within that range. In a recent working paper, Iliev & Welch (2010) argue that the reason for this disparity in estimates is misspecification of the dynamic process for leverage assumed by the partial-adjustment model. Partly, this is due to the fact [also recognized by Chang & Dasgupta (2009) and Elsas & Florysiak (2010)] that market leverage ratios are bounded between 0 and 1. These authors demonstrate that one estimator that is robust to this misspecification suggests an SOA below 0, implying that leverage is not truly mean reverting.

4.1.2. Other evidence on leverage targeting. Despite a good deal of research, the rate of mean reversion in leverage ratios remains an open question. Even if this issue could be resolved, however, it would not resolve the broader question of what economic forces motivate within-firm leverage changes. As several authors have noted, mean reversion is not sufficient to show that firms try to maintain a target capital structure. For example, Chang & Dasgupta (2009) demonstrate that simulated data in which firms choose randomly between debt and equity to meet their financing deficit produces significant SOA estimates of similar magnitude to those reported in the literature. This mechanical mean reversion can result from two sources. One is the boundedness of leverage mentioned above. Second, as noted by Shyam-Sunder & Myers (1999), serial correlation in financing deficits and profitability can give the appearance of mean reversion when firms follow a pecking order of financing choices with no explicit target.

In response, other studies have looked for evidence of leverage targeting outside of the standard partial-adjustment framework. Hovakimian et al. (2001) use a discrete choice model to show that the debt-equity choice in issuing and repurchasing securities is a function of deviation from target leverage combined with market conditions. [Welch (2004) argues that issuance choice alone is insufficient to describe leverage policy, given that many issuances (e.g., equity issues by low leverage firms) have little effect on leverage.] Similarly, Kayhan & Titman (2007) show in an extended partial-adjustment framework that over longer time horizons (5–10 years), cumulative financing deficits, market timing opportunities, and reversion to leverage targets all play a role in determining leverage changes. Alti (2006) examines the persistence of market timing by comparing post-IPO leverage changes in hot and cold issuance periods. He finds that firms that go public in hot markets issue more equity, leading to lower post-IPO leverage. However, they subsequently issue more debt and less equity than their cold-market counterparts, resulting in similar leverage ratios within two years. [Although this evidence suggests the importance of leverage targets, Chang & Dasgupta (2009) show that the findings in Kayhan & Titman (2007) and Alti (2006) could also result from mechanical mean reversion.]

4.2. Dynamic Trade-Off Models

A growing literature argues that empirical evidence is more consistent with the trade-off model than previously recognized. However, these papers argue that traditional models lack a full consideration of capital structure dynamics. Although the partial-adjustment models discussed above are dynamic, they implicitly assume that each period's capital structure choice is driven by a comparison of actual to target leverage. Models that derive the optimal dynamic policy show that this need not be the case. For example, in costly adjustment models (Section 4.2.1), optimal policy is described by initial leverage and recapitalization boundaries, rather than leverage targets; in endogenous investment models (Section 4.2.2), financing decisions depend not only on the associated tax benefits and distress costs, but also on their effects on future investment and financing choices. A primary contribution of this literature is to demonstrate that (under the assumptions of the model) many features of the empirical data can be generated from a (dynamic) trade-off model in which traditional market frictions (e.g., taxes and bankruptcy costs) play a prominent role.

4.2.1. Costly adjustment models. Two types of dynamic trade-off models have received the most attention in the empirical literature. The first explores dynamic policy in the presence of costly restructuring. In Fischer et al. (1989) firms trade off the tax benefits and distress costs of debt as in the static trade-off model. However, they receive annual shocks to asset values and recapitalization is costly. This implies there is not an optimal level of leverage, but an optimal range. Firms are inactive with respect to capital structure as long as leverage stays within that range and they only make adjustments when leverage hits an upper or lower recapitalization bound. Goldstein et al. (2001) generate similar dynamics in a model in which costs of retiring debt are infinite, but the firm retains an option to increase leverage if firm value hits an upper boundary.

Several papers show that costly adjustment models account for several empirical properties of leverage often considered inconsistent with the (static) trade-off model. Strebulaev (2007) shows that data simulated from a model similar to those described above produce a negative correlation between leverage and profitability, a large effect of recent stock returns, and slow mean reversion. Further, the cross-sectional relationships between leverage and firm characteristics can be quite different when using observations at refinancing points (i.e., just after firms recapitalize) versus using all observations. Kurshev & Strebulaev (2007) show that a similar model can account for an inverse relation between leverage and firm size. Hackbarth et al. (2006) and Bhamra et al. (2010) present costly adjustment models that can account for the dynamic relation between leverage and macroeconomic characteristics.

Other studies find empirical support for costly adjustment models. Leary & Roberts (2005) use a duration model to capture infrequent adjustment in a dynamic discrete choice framework. Three key results support the costly adjustment view. First, firms make lumpy capital structure adjustments, on average once every four quarters, but clustered in time. Second, the conditional probability of a given adjustment in the next period is a moderately decreasing function of the time since the last adjustment, consistent with convex adjustment costs (Altinkiliç & Hansen 2000). Third, an increase (decrease) in leverage relative to target decreases the time until the next leverage decreasing (increasing) change in net debt. Byoun (2008) and Faulkender et al. (2011) further support the costly adjustment view by showing that in a partial-adjustment model, the estimated SOA is a decreasing function of estimated adjustment costs.

4.2.2. Endogenous investment models. The second class of dynamic models explains observed capital structure patterns by endogenizing corporate decisions such as investment. [Mauer & Triantis (1994) published an early model of dynamic capital structure with adjustment costs and endogenous investment.] Hennessy & Whited (2005) offer a dynamic trade-off model that generates persistence in debt levels and a negative correlation between profitability and leverage without requiring large adjustment costs or infrequent issuance activity. In addition to the tax benefit and bankruptcy cost of debt, there is a proportional flotation cost of equity issuance (which amplifies the cost of raising equity) and a personal tax on equity distributions (which decreases the value of equity payouts). Thus, a key element of financing choice is the sign of current and expected future net equity issuance. Debt issues are most costly when they increase current equity payout or future equity issuance. Because firms with high lagged debt or low profitability are more likely to raise than distribute equity capital, leverage levels are persistent and negatively correlated with lagged liquidity. Hennessy & Whited simulate data from their model and demonstrate that it has these properties. They further use actual data to estimate the structural parameters of their model via a simulated method of moments. They find their model is able to match most moments of the empirical data well with empirically reasonable equity flotation costs.

Tserlukevich's (2008) model also generates a negative relation between profitability and leverage, mean-reverting leverage ratios, and a dependence of leverage on past stock returns. Here, refinancing is costless, but there is a fixed cost of exercising irreversible investment opportunities. Installed capital produces taxable income, but unexercised growth options do not. Given the investment frictions, debt policy therefore does not immediately respond to changes in the value of investment opportunities. Tsyplakov

(2008) generates a similar prediction by incorporating a time to build constraint into a dynamic trade-off model.

More recently, DeAngelo et al. (2010) present an endogenous investment model that generates low leverage targets and matches the slow adjustment speeds discussed earlier, in the context of a tax-bankruptcy trade-off. Leverage targets are low because they reflect not only tax benefits and distress costs, but the option to fund future investments in the face of limited debt capacity. Firms may temporarily deviate from target (which lowers SOA) by issuing debt to fund investment opportunities when equity issuance and cash holdings are costly. [See also Titman & Tsyplakov (2007), Sundaresan & Wang (2011), and Morellec & Schürhoff (2010a,b).]

5. CONCLUSIONS AND FUTURE DIRECTIONS

The papers summarized above collectively advance our understanding of corporate capital structure decisions, though none by itself addresses all the unanswered questions. Below, we identify challenges facing each of these lines of research, with an eye toward highlighting fruitful areas for future research.

5.1. Outstanding Capital Structure Issues

5.1.1. Mismeasurement. Existing studies argue convincingly that careful measurement of key variables of interest (e.g., marginal tax rates and expected bankruptcy costs) is crucial for detecting the influence of frictions on capital structure choices. What is less clear, and a remaining challenge for future research, is how far these adjustments, by themselves, take us in resolving the capital structure puzzle (of addressing shortcomings in traditional models, including leaving the bulk of capital structure variation unexplained). Even though these adjustments have improved the statistical modeling of capital structure, each is only a partial fix and still leaves much capital structure variation unexplained. Though it would be a daunting task, no paper attempts to combine these corrections in one unified analysis. Even if all the adjustments were made simultaneously, it is unclear whether the end result would explain substantial capital structure variation. Finally, as is clear from examining **Table 1**, the common variables used to measure capital structure appear to have nonlinear relations with the dependent variables, and yet few empirical tests explicitly account for these nonlinearities.

5.1.2. Labor contracting. The existing evidence shows that there are indeed interactions between contracting with investors and contracting with nonfinancial stakeholders. A remaining question is whether this effect is concentrated in certain industries (e.g., with high unionization) or is an important consideration that can be generalized across a broad sample. Graham & Harvey (2001) do not find broad acknowledgment of labor effects among surveyed CFOs, though this may be a difficult issue to investigate via a survey. And, to the extent that it is a bigger consideration in some industries than others, can labor account for variation within industries or only across industries? In sum, are labor effects first-order capital structure drivers?

5.1.3. Supply side. The literature has established that supply factors are a relevant (and previously underemphasized) determinant of individual firm financing choices and cross-sectional leverage differences. The questions that remain are more challenging. For example, to what extent do these effects operate through quantity restrictions versus price mechanisms? Under what conditions and in which segments do capital supply shocks have the largest impact on capital structures? To what extent do innovations that reduce market frictions mitigate the role of supply factors? [See Loutskina & Strahan (2009) for interesting evidence with respect to securitization in the mortgage industry.] Finally, negative post-issuance returns suggest an unexplored challenge for the equity supply literature: Negative long-run returns suggest that companies did not issue enough equity during the window of opportunity because equity value was apparently still high immediately after the SEO (seasoned equity offering). What forces restrict equity issuance to be below the level that maximizes (current) shareholder value?

5.1.4. Financial contracting. The financial contracting view provides new insights beyond those offered by traditional models that take existing securities as given. This literature is helpful in understanding why observed financial contracts are structured as they are, and perhaps provides guidance for improving contract structures. What is less well understood is the extent to which these insights help account for the unexplained variation in leverage ratios, and also whether they are the first-order issues that would concern a financial manager. For example, although the issues and interpretations from the incomplete contracts literature differ somewhat from the traditional models, this is not to say that the traditional issues are any less important than the new contracting issues.

One helpful contracting insight is the link between asset liquidation values and debt capacity, which by now is empirically well established. Among the open questions is the degree to which contract features such as covenants and renegotiation affect debt-equity choices. For example, Roberts & Sufi (2009b) show that covenant violations trigger control rights changes and thereby influence financing choices ex post. It would be interesting to know whether the fear of losing control rights, or limits on renegotiation, drive firms to non-debt financing ex ante. Finally, to date there has been little empirical testing of the dynamic contracting models (e.g., DeMarzo & Fishman 2007).

5.1.5. Speed of adjustment and leverage targeting. The question of whether firms behave as if managing leverage to a target is an important and still open question. However, in our view, more work refining estimates of partial-adjustment parameters may not be the most fruitful path to answering this question. First, as mentioned, several authors have questioned the power of these models to distinguish leverage targeting from alternative policies. Second, there is not a clear null hypothesis. In other words, although adjustment speeds near 0 or 1 may be informative, it is not clear whether knowing the true SOA is 15%, 25%, or 35% significantly enhances our understanding of the motives behind financing decisions. Rather, new methods outside the partial-adjustment framework may be necessary to identify the circumstances under which firms make deliberate, value-relevant financing decisions and when they fail to do so.

5.1.6. Dynamic trade-off models. Although these models have successfully shown that simple tax-bankruptcy frictions could generate data consistent with what is observed, they have not yet shown that these frictions are in fact first-order drivers of financial policies. For example, several models generate a persistent negative relation between past equity returns and leverage, suggesting that the existence of this pattern in the data is not sufficient to reject the trade-off model. This is a useful insight. However, two caveats are in order. First, as noted by Welch (2011a), the quantitative calibrations are conditional on the assumption that all capital structure variation is attributable to the select forces (and functional forms) included in the model. Second, the ability of simulations from a structural model to match sample moments does not by itself reject alternative explanations, such as the market timing view of Baker & Wurgler (2002). More work is warranted in comparing the model fit or predictive ability of dynamic structural models against plausible alternatives. In addition, structural models typically are calibrated to explain the average firm, and it is often not clear the extent to which they help explain cross-sectional heterogeneity, which, as we saw in **Table 2**, is a primary source of capital structure variation.

5.1.7. Value-relevance of capital structure choices. The implication that, for many firms, the value function is flat for ±25% or more deviation from optimal is intriguing because it implies that for many firms, capital structure choices are not first-order important. This may explain why it is difficult to document significant results in the broad panel. It also raises the possibility that empirical tests should focus on the subset of firms for which capital structure is most value relevant. It is also important to consider why estimated value functions may appear flat for many firms. Is it that capital structure truly does not matter for these firms, or could it possibly be that the value functions are estimated over a wide range of firms, perhaps averaging away offsetting effects across firms? Or, is the flatness of the value function related to the range of inaction predicted by costly adjustment models? Finally, we note that value functions have not been estimated conditional on governance or contracting characteristics.

5.2. Summary and Overarching Questions

We started by noting that extant research has explained only a portion of observed capital structure behavior. We reviewed recent progress into understanding whether the struggle to explain capital structure is driven by researchers having investigated the wrong models and issues, because key variables are mismeasured, because the managerial decision process is misspecified, or because managers are locally indifferent. Many individual fixes have recently been made (e.g., well-measured proxies, supply factors, stakeholder effects, etc.) but it is still not clear what it all adds up to.

We conclude with some issues that cut across the categories summarized above:

1. We know that firm fixed effects capture a large part of the unexplained capital structure variation. More work is needed to identify which firm-specific, and in particular time-invariant, characteristics are missing from our models.
2. Leary & Roberts (2010) suggest that we can now explain issuance decisions fairly well but to date, much variation in leverage ratios remains unexplained. Are large, deliberate changes in capital structure easier to explain than changes or levels on the broad sample of observations? [In a recent study, DeAngelo & Roll (2011) find that large leverage changes coincide with changes in investment policy.]
3. Although directional effects of various market frictions have been documented, less is known about which of these frictions is most important for capital structure decisions.
4. Which samples are most appropriate for testing capital structure theories? The most relevant market frictions are likely to vary across different subsamples. For example,

costly adjustment models are likely to be most empirically relevant for small, opaque firms, whereas the pecking order applies more to mature, high assets-in-place firms. Thus, we may gain more clarity on the drivers of financing decisions by focusing on appropriate subsets of firms.

5. How are leverage and debt structure decisions related? Supply-side and financial contracting views suggest debt structure and leverage are tightly linked. Perhaps we should consider these as joint, rather than sequential, decisions. Billett et al. (2007), for example, make progress in this dimension, though finding reliable instruments remains a challenge. More broadly, capital structure decisions are likely made jointly with other corporate policies such as payout and governance, an issue that warrants more research attention. [See, for example, Smith & Watts (1992).]
6. The variety of capital structure issues that have recently been investigated is impressive. Going forward, how can researchers decide which issues to investigate next, or which results are more important? One consideration might be which issues are most value relevant. For example, is it more important to understand a firm's ratio of total debt to value or whether the debt is composed of short-term debt, long-term debt, or a debt substitute? Although difficult to determine, the value relevance of these issues might help guide the profession going forward.

Though in this review we have focused on research published in the last six years, we expect that the questions raised herein will be relevant for many years to come.

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Errata

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