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The Influence of Firm Maturation on Firms' Rate of Adjustment to Their Optimal Capital Structures

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ABSTRACT

Extant empirical research on firms' adjustment to their optimal capital structures is cross-sectional. However, Scholes and Wolfson (1989) argue that refinancing costs that accumulate with age increasingly impede firms from restoring their optimal capital structures. This study provides evidence on the time-series variation in the rate at which firms move toward their leverage targets that is consistent with this prediction. In separate tests, age is measured from two dates—from firms' initial public offerings and from their incorporation—to examine whether the duration of their public and private experience, respectively, affect the evolution in financial policies. This paper contributes to the literature by developing a research design that isolates the influence of dynamic refinancing costs on the leverage adjustment problem. The evidence also justifies future research on Scholes and Wolfson's (1989) predictions about the time-series pattern in firms' tax shields by empirically validating that refinancing costs increasingly constrain their capital structures.

INTRODUCTION

Following Modigliani and Miller's (1963) tax correction paper, it has been suggested that the deductibility of interest for corporate income tax purposes should induce some firms to have a relatively high proportion of debt in their capital structures; i.e., leverage should be positively associated with firms' marginal tax rates. Although extant theory, such as Miller (1977) and DeAngelo and Masulis (1980), contributes testable hypotheses that specify relations among capital structure, tax rates, and nondebt tax shields, evidence supporting these predictions has been elusive.[1]

[1] For example, cross-sectional studies by Taub (1975), Marsh (1982), Stickney and McGee (1982), Auerbach (1985), Chaplinsky (1987), Titman and Wessels (1988), Fischer et al. (1989), Barclay et al. (1995), and Gupta and Newberry (1997) do not consistently find a positive relation between tax status and financial leverage.

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In fact, despite recent empirical evidence that taxes affect financing decisions, e.g., MacKie-Mason (1990), Givoly et al. (1992), Graham (1996), and Graham et al. (1998), their economic significance to firms' capital structures appears to be modest. Graham (2000) estimates the magnitude of the tax benefits of debt relative to total firm value. Paradoxically, he finds that large, liquid, profitable firms in stable industries with low expected financial distress costs—seemingly ideal candidates for exploiting interest deductions—persistently use debt conservatively. Similarly, Parrino and Weisbach (1999) report that the agency costs of debt are not sufficient to offset the tax benefits, which also implies that firms are underlevered.

In a discussion paper, Scholes and Wolfson (1989) describe their expectations on how firms' financial policies are affected by age, taxes, and leverage adjustment costs. They partially attribute the scarcity of evidence that taxes affect financing decisions to research designs that neglect to specify the capital structure problem so as to include dynamic refinancing costs. Scholes and Wolfson (1989) suspect that these costs gradually increase as firms mature, which in turn moderates the influence of taxes on debt ratios. They predict that leverage decisions become more constrained over time by refinancing costs that accumulate with age, which increasingly impedes firms from restoring their optimal capital structures.

This study examines the impact of refinancing costs on firms' capital structures in their early public years. The tests that follow provide evidence on Scholes and Wolfson's (1989) prediction about the evolution in refinancing costs by estimating the firm-specific time-series pattern in the rate of adjustment to their optimal capital structures over the nine years following their initial public offerings. These tests are designed to measure the fraction of the distance between actual and target leverage the firm moved in each of these years.

While theoretical research on capital structure, discussed below, highlights the importance of restructuring costs, existing empirical research largely ignores contracting costs other than those associated with reorganizing financially distressed firms.[2] Myers (1984, 578) in his presidential address to the American Finance Association comments:

> Large adjustment costs could possibly explain the observed wide variation in actual debt ratios, since firms would be forced into long excursions away from their initial debt ratios....If adjustment costs are large, so that some firms take extended excursions away from their targets, then we ought to give less attention to refining our static trade-off stories and relatively more to understanding what the adjustment costs are, why they are so important and how rational managers would respond to them.

Refinancing costs remain important to the scholarly debate about whether firms have optimal capital structures. Those arguing that target leverage exists frequently identify transaction costs as the reason that firms gradually, rather than instantaneously, adjust their financing in response to changes in, for example, tax incentives. However, cross-sectional evidence is mixed on whether the magnitude of refinancing costs is sufficient to explain firms' leverage decisions; e.g., Taggart (1977), Marsh (1982), Jalilvand and Harris (1984), Auerbach (1985), Fischer et al. (1989), Opler and Titman (1996), Shyam-Sunder and Myers (1999), and Graham and Harvey (2001).[3] By using a time-series research design, the tests that follow contribute to our understanding of the role of refinancing costs in impeding firms from attaining their tax-efficient capital structure.

Further, the tests in this paper attempt to follow Shevlin (1999, 438), who advises empirical tax researchers to more precisely model such nontax costs:

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[2] Exceptions include Lev and Pekelman (1975), Jalilvand and Harris (1984), and Fischer et al. (1989).

[3] This research also contributes to the growing capital markets literature in accounting and finance that examines firms in their early public years. For example, Lang (1991) and Mayers (1998) provide evidence on the evolution in firms' earnings response coefficients and their financing with convertible securities following their initial public offerings, respectively. Further, this study belongs to the empirical research stream that concerns the influence of history on firms' capital structures, which includes evidence that firms tend to issue equity after a recent increase in stock prices (e.g., Masulis and Korwar 1986) and debt after accumulating substantial profits (e.g., Opler and Titman 1996).

> I would like to see future research in the non-tax costs area push harder to refine the tests so that we can better understand the role of non-tax costs and also begin to quantify their magnitude. I think it is well accepted that firms trade-off tax benefits with non-tax costs....I would like to see more effort expended in carefully laying out the likely non-tax costs in any setting and proxies for these non-tax costs factored into the research design.

This study also responds to Myers' (1984) call for research that improves our understanding of refinancing costs by reporting on the time-series variation in firms' reversion to their target leverage. The research design applied below represents a more complete specification of the capital structure adjustment problem by isolating the influence of dynamic refinancing costs. These tests provide evidence consistent with Scholes and Wolfson's (1989) prediction that firms have less flexibility to choose optimal capital structures with age. Specifically, empirical results suggest that firms' rate of adjustment to their target leverage gradually slows over their first nine public years. In separate tests, this evidence is robust to four specifications of firms' target leverage, which is important since there is no single generally accepted proxy for firm-specific optimal capital structure in the corporate finance literature.

This study also helps motivate future research on the time-series variation in firms' tax-induced financing and investment decisions by empirically validating the argument that refinancing costs increasingly constrain firms' capital structures. In fact, the negative time-series pattern observed in firms' reversion to their optimal capital structures could be considered a prerequisite to testing Scholes and Wolfson's (1989) predictions about the evolution in firms' tax shields. For example, these predictions include that the relation between financial leverage and marginal tax rates will become less positive as firms age.

This paper continues as follows. The next section further develops the motivation for the empirical tests, while section three describes the sample selection procedure. Section four presents the primary estimation methodology and results for tests that specify a firm's age as the number of years that have passed since its initial public offering. The specification checks in section five include examining whether cross-sectional variation in firms' private ages, measured as the number of years between their incorporation and their IPOs, matters to the time-series evidence from the target adjustment models reported earlier. Finally, section six concludes with a summary of the paper and discusses implications for future research.

REVIEW OF EXTANT LITERATURE AND HYPOTHESIS DEVELOPMENT

This section reviews the analytical and empirical literature relating to Scholes and Wolfson's (1989) argument that refinancing costs affect the time-series variation in firms' rate of adjustment toward their optimal capital structures. Although no study directly tests their prediction that issuing and retiring securities becomes more difficult with age, there is theory and evidence on the pattern of certain refinancing costs in firms' early public years. This review examines whether extant research generally implies that firms' financing decisions gradually become more constrained over time.

The irrelevance propositions formally derived by Modigliani and Miller (1958, 1963) (hereafter MM) include the result that a firm's financing should not affect its market value. They demonstrate that capital structure does not matter for firms operating in an economy characterized by the following highly restrictive conditions: there are no corporate or personal income taxes, there are no informational asymmetries, investment policy is not influenced by financing or dividend decisions, and there are no contracting costs.

The assumptions underlying the MM model are so unrealistic that the irrelevance propositions could be criticized for being irrelevant. Yet, as explained by Harris and Raviv (1991) and others, a subtle, but very salient contribution of the model is its guidance on where *not* to look for the actual determinants of capital structure. Subsequent analytical research has examined the effect on leverage decisions of systematically relaxing the MM conditions.

Refinancing costs do not exist in a Modigliani and Miller (1958, 1963) world since firms inhabiting their stylized economy can instantaneously adjust their capital structures.[4] In reality, these costs may impede firms from altering their capital structures to exploit, for example, changes in their tax rates.

Refinancing costs may take several forms. For example, some public debt may only be redeemable at par, although its market value may be less than this amount. Premia are often necessary to persuade current bondholders to tender their securities and any gain on debt repurchase would be considered a taxable event to the issuer.[5] Frequently, bond indentures restrict additional debt issues and penalize or prohibit early retirement. Firms may also be deterred from altering their equity securities to restore their optimal capital structures.[6] Myers and Majluf (1984) model a pecking order of financing that is attributable to asymmetric information between managers and potential investors. Leverage adjustments are costly because of the tendency of investors to discount the value of new securities, particularly equity, as compensation for their informational disadvantage. In addition, relatively high flotation costs induce firms to issue equity only occasionally (Smith 1977). Finally, costs are incurred when capital structure decisions distract management from operating the business.

However, more relevant to this study is prior research on the time-series variation in specific refinancing costs, which generally suggests that these impediments accumulate with age as firms' capital structures become less flexible and more complex. Scholes and Wolfson (1989) argue that the temporal structure of investment and financing decisions may constrain firms' leverage choices. They suspect that capital structure is largely a legacy of decisions made over a firm's existence. Relative to seasoned firms, younger companies may not be as burdened by their histories such that their capital structure refinancing costs may be lower.

There is considerable empirical evidence that suggests that capital structure characteristics consistent with higher refinancing costs and less flexibility are more prevalent among older firms. For example, Helwege and Liang (1996) provide descriptive statistics on the time-series pattern of seasoned equity, public bond, and private debt offerings by a sample of firms that underwent an IPO in 1983 that support this argument. They report that firms access capital markets less frequently as they mature, with issues primarily occurring in the first four years following IPO and declining steadily thereafter.[7]

Krishnaswami et al. (1999) document that firms gradually shift from private debt toward public debt as they mature, which may undermine their capital structure flexibility (see also Slovin et al. 1994; Datta et al. 1999). Extensive theory and evidence suggests that private lenders, which are mainly institutions such as commercial banks and life insurance companies, are more flexible; e.g., Nakamura (1989), Berlin and Mester (1992), Rajan (1992), Gorton and Kahn (1993), Chemmanur and Fulghieri (1994), and Preece and Mullineaux (1996). In fact, this research is corroborated by studies that find that private loans are frequently renegotiated; e.g., Beneish and Press (1993),

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[4] For expositional convenience, the term "refinancing costs" refers to a broad range of contracting costs other than the direct or indirect reorganization costs incurred by financially distressed firms.

[5] Traditionally, publicly traded bonds have been restructured through voluntary exchange offers that can involve severe holdout problems. Although there are ways to arrange the exchange offer to penalize holdouts, these typically only ensure that the bondholders that tendered are in a better position if the firm subsequently files for bankruptcy (Gilson 1991).

[6] The very existence of firm-specific optimal capital structure continues to be the subject of much debate in the finance literature (e.g., Shyam-Sunder and Myers 1999; Chirinko and Singha 2000; Frank and Goyal 2000; Graham and Harvey 2001).

[7] Helwege and Liang (1996) argue that the attractive capital market conditions for issuing securities that prevailed in the early 1990s suggests that the gradual reduction in issues with age cannot be explained as simply an artifact of the years examined. They do not control for the economic conditions occurring in the decade following the 1983 IPOs. As explained below, the research design used in this study at least partially stifles potential confounding arising from shifts in macroeconomic conditions.

Carey et al. (1993), and Kwan and Carleton (1995). Accordingly, the tendency of firms to gradually substitute public debt for private debt with age implies that this coincides with a reduction in their capital structure flexibility.

Moreover, not only is public debt less readily renegotiable, but also it is inherently less flexible for other reasons, further impeding firms' reactions to changes to their financing.[8] For example, the free-rider problem can prevent the renegotiation of public debt (Grossman and Hart 1980; Gertner and Scharfstein 1991) and mean maturities of public debt are longer (Lummer and McConnell 1989; Guedes and Opler 1996; Datta et al. 2000).

Extant theoretical and empirical research suggests that the presence of public debt in firms' capital structures also affects renegotiations with private lenders. For example, Park (2001) argues that when a secured (usually private) lender is better informed than unsecured (usually public) lenders, informational asymmetry will impede restructuring debt involving both classes of creditors. Gilson et al. (1990) report that firms are less likely to restructure privately as the fraction of public debt to total liabilities increases. Asquith et al. (1994) observe that banks seldom offer concessions to firms with noninvestment-grade public debt outstanding. Similarly, James (1995) finds that banks only provide concessions to firms attempting to recover from financial distress when public debt-holders also agree to renegotiate their claims.

Further, there is evidence that firms gradually reduce their financing with securities that have intrinsic repayment flexibility. For example, Mayers (1998) finds that firms' reliance on convertible debt is decreasing in firm age; Helwege and Liang's (1996) descriptive statistics support this evidence. Several studies (e.g., Gupta 1969; Schmidt 1976; Titman and Wessels 1988) detect that small firms have more short-term debt in their capital structures, which relates to age since median firm size is found to gradually increase over time in this paper. Scholes and Wolfson (1992) maintain that, although more expensive than long-term debt, short-term debt provides more flexibility for firms to choose optimal capital structures. In summary, prior research suggests that as firms gradually substitute public debt for private debt with age, they experience reduced financing flexibility.

The evolution in firms' external financing decisions with age suggests that their capital structures also gradually become more complex. For example, Helwege and Liang (1996) report that the quantity of debt issues increases at a decreasing rate over firms' first decade of public operation. This can be interpreted as implying that adjusting capital structure becomes more difficult since covenants frequently prohibit or penalize subsequent debt issues such that more contracts result in more financing restrictions. Also, Gilson et al. (1990) and Asquith et al. (1994) find that firms with more classes of debtholders are more apt to resolve financial distress with a costly Chapter 11 filing. Their evidence supports Bolton and Scharfstein's (1996) argument that increasing the number of creditors complicates debt renegotiations.[9]

This literature review generally corroborates Scholes and Wolfson's (1989) argument that firms' capital structures gradually become more constrained by refinancing costs with age. This implies that firms are increasingly impeded over time from attaining their optimal capital structures, which motivates the hypothesis tested in this study (stated in alternate form):

H1: The rate of adjustment to firm-specific optimal capital structure will slow as firms age.

However, certain effects arising from the time-series variation in information transparency and flotation costs on issuing securities may obstruct the detection of this pattern. The rapid adjustment

[8] Extant analytical and empirical research is not unanimous that the addition of public debt reduces capital structure flexibility; e.g., Datta et al. (2000) provide evidence consistent with Diamond's (1991b) argument that increased financing flexibility is afforded to high growth firms by the introduction of public debt.

[9] However, Helwege's (1999) evidence on junk bond defaults indicates that the number of bond classes outstanding and whether the debt is publicly traded do not seriously affect the bargaining process. In contrast to Gilson et al. (1990), Chatterjee et al. (1996) find that firms with more bank debt in their capital structures tend to resort to a traditional Chapter 11 filing rather than a prepackaged bankruptcy or a private workout.

to target leverage predicted for young firms might be moderated by age being a determinant of the availability and cost of borrowing.

Consistent with these information asymmetries being more severe in young firms, Krishnaswami et al. (1999) report that firms substitute public debt for private debt as they age. Their evidence supports Diamond's (1991a) prediction that borrowers, who initially depend on the financial intermediation of private debt placement to alleviate moral hazard, eventually begin to shift toward financing with public debt when they have acquired a reputation for repaying loans. Diamond's (1991a) theory predicts that firms attempt to establish a credit history for servicing their loans, which lowers their cost of capital and reduces credit rationing.

There is considerable evidence that borrowing costs are higher and credit is less available for young firms (e.g., Dennis et al. 1988; Petersen and Rajan 1994, 1995; Berger and Udell 1995; Cole 1998; Datta et al. 1999). Lang (1991) provides theory and evidence that the magnitude of stock price reactions to earnings announcements decline with age, which is interpreted as indicating that firm-specific information is gradually revealed. In fact, empiricists have often specified age as a proxy for the extent of *ex ante* uncertainty about firm value; e.g., Carter and Manaster (1990), James and Weir (1990), and Ritter (1991).

Younger, smaller firms not only have to contend with more acute asymmetric information problems when obtaining financing, but also if there are economies of scale in the cost of issuing securities (Smith 1977, 1986; Blackwell and Kidwell 1988), then larger firms may alter their capital structures more frequently since their transactions costs are lower. For example, Jalilvand and Harris (1984) detect that large firms adjust more quickly to target long-term debt, which they attribute to lower flotation costs and better access to capital markets.

Carey et al. (1993) find that only public debt issues exceeding $100 million are cost-effective, although private debt placements are economical for smaller issues. Descriptive statistics for the first nine public years of sample firms examined in this study indicate that firm size increases every year. This implies that certain refinancing costs; i.e., flotation and asymmetric information costs for new issues, may be decreasing, thereby reducing the power of the tests to identify the predicted negative trend in the rate of adjustment to target leverage.

In summary, while there may be some refinancing costs that gradually decrease, prior analytical and empirical research generally suggests that refinancing costs are increasing in firm age, which is consistent with Scholes and Wolfson's (1989) argument. The following tests estimate firms' rate of adjustment toward their optimal capital structures to formally examine their prediction that financial policy gradually becomes more constrained over time.

SAMPLE SELECTION

The sample used to observe the time-series properties of firms' rate of adjustment to their optimal capital structures includes firms that went public from 1977 to 1988. This is the maximal period that contains nine consecutive years of the Compustat data used in this study.

A listing of the 3,458 SEC-registered initial public offerings conducted between January 1, 1977 and December 31, 1988 was obtained from Security Data Corporation. This listing was compared to the Annual Industrial and Research Compustat files to identify the IPOs for which any Compustat data was available. Table 1 reports that this procedure reduced the sample to 2,180 firms. The deletion of firms from the utilities (defined as SIC codes from 4911 to 4941), financial (SIC codes from 6022 to 6200), insurance (SIC codes from 6312 to 6400), and real estate (SIC codes from 6500 to 6799) industries eliminated an additional 249 firms.[10] These industries were excluded because their capital market behaviors are considered to be fundamentally different from that of other firms due to regulation and the financial nature of their operations (MacKie-Mason 1990; Rajan and Zingales 1995).

[10] In addition to utilities, other industries were regulated at different points during the 1977 to 1998 period of this study. All results reported in this paper were virtually identical when firms operating in the railroad (SIC 4011), trucking (SIC 4213), airline (SIC 4512), and telecommunications (SIC 4812 and 4813) industries were removed from the sample.

TABLE 1
SAMPLE SELECTION SUMMARY

	Calendar Year												
	1977	**1978**	**1979**	**1980**	**1981**	**1982**	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**Total**
Number of SEC registered IPOs	32	38	62	149	348	122	685	357	355	728	415	167	3,458
Number of firms not followed by Compustat since initial public offering	(11)	(20)	(22)	(67)	(125)	(40)	(246)	(129)	(131)	(290)	(150)	(47)	(1,278)
Number of firms from utilities, financial, insurance, and real estate industries	(2)	(3)	(4)	(11)	(26)	(7)	(51)	(24)	(29)	(53)	(27)	(12)	(249)
Number of firms that did not survive through their first nine years of public operation	(12)	(2)	(10)	(27)	(83)	(36)	(178)	(111)	(96)	(166)	(100)	(50)	(871)
Number of firms with missing Compustat observations	(7)	(7)	(10)	(20)	(44)	(21)	(90)	(41)	(53)	(95)	(47)	(26)	(461)
Number of firms in the sample	0	6	16	24	70	18	120	52	46	124	91	32	599

This study follows firms from their first through their ninth public years, which results in the removal of firms that were de-listed from the Compustat database because of mergers, acquisitions, bankruptcy, or liquidation during this period. Requiring nine consecutive years of data, which further reduced the sample to 1,060 firms, may introduce survivorship bias. For example, the sample probably includes relatively few severely financially distressed firms, especially in the early years of the panel.

Retaining firms with any observations, i.e., permitting firms to enter and leave the sample, would reduce potential survivorship bias. However, allowing the sample composition to change over time could lead to severe identification errors in interpreting test results. We later consider the implications of sample attrition in the sensitivity tests.

Finally, firms were removed from the sample if any of the observations necessary to construct the regression variables were missing. This restriction reduced the sample to 599 firms (see Table 1 for a summary).[11] As applying these screening criteria results in the attrition of 82.7 percent of the original sample, the final sample may differ systematically from the population of IPOs occurring between 1977 and 1988; e.g., these restrictions might bias the sample toward larger firms in certain industries (see Table 2).[12] However, inspection of the data suggests that the industry and calendar-year clustering in the sample resembles the clustering in the population.

EMPIRICAL METHODOLOGY AND RESULTS

Introduction

The purpose of the following regressions is to provide evidence on the time-series variation in firms' rate of adjustment to their target leverage. These tests will complement the existing literature which mainly, although not unanimously, implies that refinancing costs are increasing in firm age as capital structures become less flexible and more complex. Scholes and Wolfson's (1989) prediction that firms' financial policies gradually becoming more constrained with age is examined by estimating the time-series pattern in the capital structure adjustment process.

The tests for firm-specific changes over time in this process begin with cross-sectional regressions that are intended to measure the fraction of the distance between actual and target leverage the firm covered during each of their first nine public years. These cross-sectional regressions provide nine coefficient estimates, each representing an average of individual firm coefficients for that year. These estimates are regressed on firm age to examine the prediction that negative time-series variation will be observed in firms' reversion to their optimal capital structures. As no single generally accepted measure of target leverage has emerged in extant research, the empirical analysis is conducted using four different proxies in separate tests.

Empirical Model of Leverage Adjustment

The following equation specifies a simple model of leverage adjustment to evaluate the potential reversion to the firm-specific optimal capital structure:

$$L_{it} - L_{i,t-1} = (1 - \delta)(L^*_{it} - L_{i,t-1}) + \mu_{it} \quad (1)$$

where L_{it} and $L_{i,t-1}$ represent the firm's leverage at the end of the current and prior years, respectively. L^*_{it} is the firm's target leverage at the end of the year absent any refinancing costs, which are instead examined with the coefficient, $1 - \delta$ ($\in(0,1)$). If refinancing costs do not affect capital structure, i.e., if $\delta = 0$, then firms are observed to be at their target leverage, i.e., $L_{it} = L^*_{it}$.

However, at the other extreme, when $\delta = 1$, equation (1) implies that firms are prevented from

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[11] Although the 599 firms are only a small fraction of the initial population of IPOs, screening criteria were carefully considered to preserve the sample.

[12] Jalilvand and Harris (1984) report that larger firms adjust more quickly toward their target leverage, which is consistent with evidence that the transaction costs on issuing and retiring securities are relatively lower for these firms; e.g., Blackwell and Kidwell (1988). If the selection criteria imposed in this study bias the sample toward larger firms, then this would probably bias the tests against finding the predicted pattern.

TABLE 2
INDUSTRY DISTRIBUTION OF SAMPLE

2-Digit SIC Code	Number	Industry Description	Percentage
13	13	Oil and gas extraction	2.2
20	14	Food	2.3
27	10	Printing and publishing	1.7
28	37	Chemicals	6.2
35	62	Industrial and commercial machinery	10.4
36	61	Electronic and electrical equipment	10.2
38	44	Measuring, analyzing, and controlling equipment	7.3
39	10	Miscellaneous manufacturing industries	1.7
48	13	Communications	2.2
50	14	Wholesale trade—durable goods	2.3
56	13	Apparel and accessory stores	2.2
58	10	Restaurants	1.7
59	17	Miscellaneous retail	2.8
73	53	Business services	8.8
80	10	Health services	1.7
87	13	Engineering, accounting, research, management, and related services	2.2
Sub-total	394		65.8
	205	Industries with fewer than 10 firms	34.2
Total	599		100

adjusting their capital structures, i.e., $L_{it} = L_{i,t-1}$. Estimates of δ between 0 and 1 would indicate the extent of path dependence in firms' financing behavior. The coefficient (1 − δ) measures the fraction of the distance between actual and target leverage the firm moved during the year. This empirical model attributes any delay in adjustment to firm-specific optimal capital structure to refinancing costs.

Empirical research using similar versions of this partial adjustment model includes Taggart (1977), Marsh (1982), Jalilvand and Harris (1984), Auerbach (1985), Gilson (1997), and Shyam-Sunder and Myers (1999). However, extant evidence of mean reversion in debt ratios or that firms gradually shift toward leverage targets is cross-sectional (see also Fischer et al. 1989; Opler and Titman 1996; Frank and Goyal 2000). The following tests examine the time-series variation in the speed of adjustment toward proxies for optimal capital structure by charting the pattern of the (1 − δ) coefficients across the firms' first nine public years.

This methodology relies on direct proxies for firm-specific optimal capital structure when estimating equation (1), e.g., Jalilvand and Harris (1984) and Shyam-Sunder and Myers (1999).[13]

[13] According to Shyam-Sunder and Myers (1999), tests similar to ours dominate extant empirical research on the capital structure adjustment process. However, we acknowledge that other approaches have been used in the corporate finance literature. For example, Frank and Goyal (2000) rely on a conditional target adjustment methodology to provide cross-sectional evidence of mean reversion in firms' leverage. Auerbach (1985) and Gilson (1997) specify target leverage as a linear function of the determinants of capital structure, excluding refinancing costs, prescribed by theory. Their approach enables the influence of refinancing costs to be isolated in the estimated coefficient on lagged actual leverage.

Firms' reactions to the assumed underlying drift from their optimal capital structures are identified through this reversion variable that measures the rate of adjustment with the coefficient $(1 - \delta)$. Hypothesis 1 implies that negative time-series variation will be observed in the rate of adjustment variable, $(1 - \delta)$, consistent with the prediction that firms are increasingly impeded by refinancing costs from restoring their optimal capital structures.

However, difficulty encountered with estimating adequate proxies for target leverage complicates the research design. To attenuate this problem, the time-series variation in firms' (potential) reversion toward their targets is examined using several different proxies for firm-specific optimal capital structure: (1) three based on a time-series mean of the firm's actual debt ratios, and (2) one based on a cross-section of all other firms operating in the same industry in the same calendar year.

Book-Based vs. Market-Based Leverage

The target adjustment tests examine the timing and extent of (potential) reversion toward firm-specific optimal capital structure. In the presence of imperfect capital markets, management is responsible for developing an optimal dynamic adjustment policy that minimizes refinancing costs and the costs from continuing to deviate from their target leverage. Accordingly, this raises the issue of whether a market-based or a book-based debt ratio should be used in these tests that are intended to isolate deliberate financing choices.

Although the theory of capital structure suggests that debt ratios should be measured using market values, book values are justified by the reliance of many rating agencies and corporate treasurers on book leverage, e.g., bond covenant restrictions apply to book, not market, values. Also, using market equity in the denominator of the leverage ratio would impound price variances arising from extraneous economic conditions. This problem might be worse in this study of newly public firms since their share prices tend to be relatively volatile.

For example, Miller (1977) argues that book leverage is more suitable for examining firms' financing decisions than market leverage, which is very sensitive to the levels of share prices. Graham and Harvey (2001) report survey evidence that chief financial officers are more concerned with book, rather than market, leverage targets. Finally, Myers (1977) explains that there may be theoretical support for specifying book values, which correspond to the value of assets in place (tangible assets provide better loan collateral) and usually exclude the capitalized value of growth opportunities.

Taggart (1977), Marsh (1982), Jalilvand and Harris (1984), Opler and Titman (1996), Gilson (1997), and Shyam-Sunder and Myers (1999) estimate targets using book rather than market values. Similarly, the following target adjustment tests are conducted with leverage specified as the book value of short-term and long-term debt divided by the book value of the sum of short-term debt, long-term debt, and shareholders' equity.[14]

Target Leverage

Any particular target proxy could be criticized for not properly estimating the firm-specific optimal capital structure. Accordingly, the concern that any evidence indicating that firms are increasingly impeded from adjusting toward their leverage targets is spuriously induced by measurement error is considered by using four target proxies.

Target leverage is first estimated using the time-series mean of the firm's debt ratio across the nine-year sample period, excluding the current year to reduce the mechanical relation with the dependent variable. For example, the target for a firm in its fourth public year is specified as the mean of its leverage for years one to three and five to nine. Taggart (1977), Marsh (1982),

[14] Unless otherwise stated, the results were qualitatively similar when the tests were rerun with market-based leverage, defined as the book value of short-term and long-term debt divided by the sum of the book value of short-term and long-term debt and the market value of shareholders' equity.

Jalilvand and Harris (1984), and Shyam-Sunder and Myers (1999) use similar proxies for firm-specific optimal capital structure.

The validity of this specification may depend on the optimum proxy remaining relatively constant to ensure that the speed of adjustment estimates, $(1 - \delta)$, are not spuriously related to changes in the target ratios.[15] In fact, volatility in the target proxies would not matter if these were measured without error, although this is almost certainly not the case. Stability in the yearly target proxies might appear to contradict Scholes and Wolfson's (1989) prediction that refinancing costs that accumulate with age induce firms to gradually drift farther from their targets.[16] In addition, if the target is relatively stable, then adjustment to it becomes less of an issue as the firm approaches the target.

Prior empirical research has also estimated target leverage with three- and five-year historical moving averages (e.g., Jalilvand and Harris 1984), which allows for more variability in the targets over time. Although this prevents examining firms' capital structures until their third full year of public operation, our second time-series proxy for the firm's target leverage is a firm's mean leverage over the three years preceding the current year.

A third proxy for target leverage is the firm's mean leverage over the three years subsequent to the current year. In some sense, this is the most appropriate measure since the firm presumably is moving toward its target over time, so the future leverage may be the best proxy for the intended leverage currently. Unfortunately, this proxy also involves a significant loss of data as additional years are required for its estimation.

Finally, industry-mean (or median) leverage has been used to represent firm-specific target debt ratios (e.g., Lev 1969; Lev and Pekelman 1975). Evans (1991) reports that restructuring consultants frequently rely on industry benchmarks when advising clients on choosing new capital structures. Graham and Harvey (2001) find that executives with public firms are concerned about the financial policies of their competitors. Several studies (e.g., Schwartz and Aronson 1967; Bowen et al. 1982; Bradley et al. 1984) detect persistent industry clustering in debt ratios, which has been interpreted as evidence supporting the existence of optimal capital structures. The contemporaneous industry-mean debt ratio of firms in the narrowest SIC code that includes at least five firms, after removing the firm being studied, in the same calendar year is specified as the fourth proxy for the firm-specific target.[17]

An argument could be made that the target leverage for a given firm-year is a function of both the proxy leverage variable and the firm's expected marginal tax rate in that year. The pooled correlation between each of the four target leverage proxies and two common proxies of marginal tax rates (a trichotomous specification from Shevlin [1990] and a continuous simulated specification from Graham et al. [1998]) is close to zero; none of these eight correlations exceeds 0.16 in

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[15] The potential presence of a calendar-year time trend in the data is at least partially suppressed by studying firms as they age; i.e., the data is aligned in event time such that IPO year is year zero in all cases. This should reduce confounding admitted by shifts in macroeconomic conditions that might affect financing decisions. Nonetheless, Jalilvand and Harris (1984) provide evidence that capital market conditions, such as management's expectations about interest rates and security prices, influence the speed of firms' adjustment to long-run leverage targets. In addition, Graham (2000) reports that firms became more aggressive in their use of debt later in the 1980–1994 period of his study. Including calendar-year time dummies in the target adjustment tests hardly affects the results reported.

[16] There may be other reasons that the evolution in firms' capital structure decisions during their first nine public years might affect the stability of the time-series target proxy. For example, past security issues may induce temporary departures from the optimal capital structure arising from firms attempting to exploit short-term market conditions (Marsh 1982). However, extending the duration over which the time-series mean for the target leverage proxy is estimated to the entire sample period should reduce the impact of this.

[17] Frequently, Compustat data was available for fewer than eight firms in a SIC code such that industry medians could not be reliably used as the measure of central tendency. The firm under study is excluded from the calculation of the industry-mean leverage to ensure that correlation with the dependent variable is not mechanically induced.

absolute value. Additionally, while approximately 60 percent of the firms had a change to their trichotomous tax rate classification during the sample period, the Pearson correlation between the mean three-year lead leverage proxy and the tax proxies is -0.07 for the trichotomous specification and -0.04 for Graham et al.'s (1998) continuous proxy. Thus, a target leverage model explicitly incorporating changes in the marginal tax rate has not been estimated since it does not appear that the contribution of the tax rate proxy to the target proxy estimation will be important.

Table 3 presents means of the annual estimates of the four proxies for target leverage. Each of the four proxies has a relatively stable distribution over time and has similar magnitude to the other proxies. The fourth proxy, industry-mean debt ratio, is somewhat lower, suggesting that, on average, sample firms, which are relatively young, have a higher leverage ratio than their competitors.[18] Tests (not tabulated) on the annual cross-sectional means provide no evidence that there is time-series variation in any of the four target leverage proxies over firms' first nine public years, which implies that parameter instability is not a serious problem.

Estimation Issues and Results

The empirical testing begins by estimating equation (1) with the nine-year time-series mean debt ratio representing target leverage. Then, these tests are repeated for the other proxies for firm-specific optimal capital structure. However, since each observation in the cross-section concerns a different firm, there are two potential problems with relying on ordinary least squares (OLS) estimation in this setting: the coefficient estimates may vary across firms and the residuals may be heteroscedastic.

To admit firm heterogeneity and to avoid serial correlation complications, equation (1) is estimated in separate cross-sectional regressions for each of the first nine public years using a random coefficients model based on Hildreth and Houck (1968) that attributes parameter heterogeneity to stochastic variation. This estimation technique, which has been modified to correct for heteroscedasticity, allows for cross-sectional variation in the nine rate of adjustment, $(1 - \delta)$, coefficients, each representing an average of individual firm coefficients for that year. Results from OLS estimation are virtually identical.

The resulting series of year-to-year estimates from the cross-sectional random coefficients model regressions using the first target leverage reversion proxy are reported in column 1 of Panel A in Table 4. The nine estimated reversion parameter coefficients (along with 90 percent confidence intervals) are also plotted in Figure 1. The Pearson correlation of these coefficients with firm age is -0.70, which is significant at the 5 percent level in a one-tailed test assuming independence.

Equation (1) is reestimated in cross-section using each of the other three proxies: the three-year historical mean debt ratio; the three-year lead mean debt ratio; and the contemporaneous industry-mean debt ratio. The coefficients that result from this exercise are presented in columns 2 through 4 of Panel A in Table 4, and graphed in Figures 2 through 4. The Pearson correlation coefficients with firm age are -0.90, -0.82, and -0.54, respectively, for the three proxies; these estimates are significant at the 1 percent, 1 percent, and 10 percent levels, respectively, in one-tailed tests assuming independence.

Although these findings support the predicted negative time-series variation in the reversion toward firm-specific optimal capital structure, the correlation statistic does not consider the variable estimation error in the coefficients. This matter is addressed by estimating a weighted least squares

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[18] Young firms may be considerably different than mature firms, which typically dominate the industry means, on important characteristics, such as size and investment opportunity sets. Jain and Kini (1994) examine the change in operating performance of firms making the transition from private to public ownership through IPOs and find that in the post-issue period these firms have high growth rates in sales and capital expenditures relative to other firms in the same industry. It could be argued that firms should have been matched on other characteristics, such as size, growth options, and profitability, as well as their SIC codes when estimating this target leverage proxy. However, this would have seriously reduced the precision of the industry matching since only broad SIC codes (usually one-digit) were available when firms were matched on other characteristics in addition to their industry.

TABLE 3
SUMMARY STATISTICS—ANNUAL CROSS-SECTIONAL MEANS OF THE VARIOUS PROXIES FOR FIRM-SPECIFIC OPTIMAL CAPITAL STRUCTURE

	Firm-Specific Optimal Capital Structure Proxy			
Post-IPO Year	Nine-Year Time-Series Mean Debt Ratio 1	Three-Year Historical Mean Debt Ratio 2	Three-Year Lead Mean Debt Ratio 3	Industry-Mean Debt Ratio 4
Year 1	0.2841		0.2492	0.2449
Year 2	0.2816		0.2668	0.2491
Year 3	0.2802	0.2449	0.2733	0.2592
Year 4	0.2796	0.2693	0.2748	0.2621
Year 5	0.2803	0.2844	0.2723	0.2533
Year 6	0.2788	0.2891	0.2634	0.2437
Year 7	0.2802	0.2879	0.2578	0.2397
Year 8	0.2787	0.2871	0.2508	0.2289
Year 9	0.2773	0.2915	0.2470	0.2199
Number of annual observations	599	599	280	514

This table presents the annual sample means for the four proxies for firm-specific optimal capital structure used in the target adjustment tests. The firm-specific optimal capital structure proxies are defined as follows. The nine-year time-series mean debt ratio includes all of the firm's first nine years of public operation except for the current year. The three-year historical mean debt ratio is the firm's time-series mean debt ratio for the three years preceding the current year. The three-year lead mean debt ratio is the firm's time-series mean debt ratio for the three years succeeding the current year. The contemporaneous industry-mean debt ratio is the industry-mean debt ratio for the same calendar year of firms in the narrowest SIC code that includes at least five firms after removing the firm under study. The firm-specific optimal capital structure proxies are specified for firms' first through ninth years of public operation, except for the three-year historical mean debt ratio, which is specified for firms' third through ninth public years. For each proxy, the debt ratio is defined as the book value of short-term and long-term debt divided by the sum of the book value of short-term debt, long-term debt, and shareholders' equity.

regression, with the weights determined by the standard errors of the coefficient estimates; i.e., the least weight is assigned to the observations that are measured with the most error. The following regression is estimated:

$$(1 - \delta)_t = \phi + \gamma \, AGE_t + \nu_t \qquad (2)$$

where $(1 - \delta)$ is the coefficient estimated in equation (1) that measures the fraction of the distance from actual to target leverage firms move in year t; and AGE is firm age which is measured as the number of years elapsed since its IPO. The results from estimating equation (2) with weighted least squares regression in separate tests for each series of reversion parameter estimates (i.e., for each target leverage proxy) are reported in Panel B of Table 4.

For the three target proxies based on the time-series mean leverage ratios for the firm, the coefficients on age are negative and statistically significant at the 1 percent level. For the reversion coefficient that is based on the industry-mean leverage target proxy, the coefficient on age has a coefficient that is negative and statistically significant at the 10 percent level. Thus, there is consistent evidence that the coefficient in equation (1) that measures the speed of adjustment to optimal capital structure decreases as firms age.

Pooled Tests

It is important to stress that this evidence, which consistently implies that the capital structure adjustment process becomes more impeded with age, depends on the adequacy of the target leverage proxies. However, the estimation of sensible proxies for target leverage is particularly difficult for this sample of maturing firms. For example, initially small and risky, these firms might systematically increase their debt ratios as they age, rather than adjust to the specified optimum (Diamond 1989, 1991a; Shyam-Sunder and Myers 1999). In fact, Pittman (2000) provides panel data evidence

TABLE 4
CROSS-SECTIONAL REGRESSIONS OF FIRMS' RATE OF ADJUSTMENT TO THEIR OPTIMAL CAPITAL STRUCTURES

Panel A: Yearly Estimates of Leverage Revisions

$$\Delta LEVERAGE_{it} = \alpha + (1 - \delta)\ REVERSION_{it} + \varepsilon_{it}$$

	Firm-Specific Optimal Capital Structure Proxy							
	Nine-Year Time-Series Mean Debt Ratio 1		**Three-Year Historical Mean Debt Ratio 2**		**Three-Year Lead Mean Debt Ratio 3**		**Industry-Mean Debt Ratio 4**	
Post-IPO Year	α	$1 - \delta$	α	$1 - \delta$	α	$1 - \delta$	α	$1 - \delta$
Year 1	0.007	0.437**			0.006	0.463**	0.038***	0.152*
Year 2	0.009	0.389**			−0.012*	0.482**	0.024***	0.101*
Year 3	0.010**	0.471**	0.022***	0.376*	0.008	0.479**	0.010	0.209**
Year 4	0.009	0.439**	0.012*	0.239	0.001	0.434**	0.010	0.158*
Year 5	0.002	0.493**	−0.003	0.241	0.007*	0.384**	0.005	0.140*
Year 6	0.008	0.478**	0.002	0.265*	0.015**	0.407**	0.016**	0.124*
Year 7	0.003	0.325*	−0.001	0.137	0.004	0.438**	0.012*	0.098
Year 8	0.010*	0.258*	0.009	0.173	0.011	0.404**	0.019***	0.108*
Year 9	0.011*	0.071	0.005	0.047	0.001	0.336*	0.013*	0.101
Annual observations	599		599		280		514	

Panel B: Regression Estimates of Relation of Age to Revision Coefficients

$$(1 - \delta)_t = \phi + \gamma\ AGE_t + \nu_t$$

	Firm-Specific Optimal Capital Structure Proxy							
	Nine-Year Time-Series Mean Debt Ratio 1		**Three-Year Historical Mean Debt Ratio 2**		**Three-Year Lead Mean Debt Ratio 3**		**Industry-Mean Debt Ratio 4**	
	ϕ	γ	ϕ	γ	ϕ	γ	ϕ	γ
Coefficient	0.537***	−0.034***	0.474***	−0.044***	0.494***	−0.014***	0.166***	−0.007*
Number of observations	9		7		9		9	

(Continued on next page)

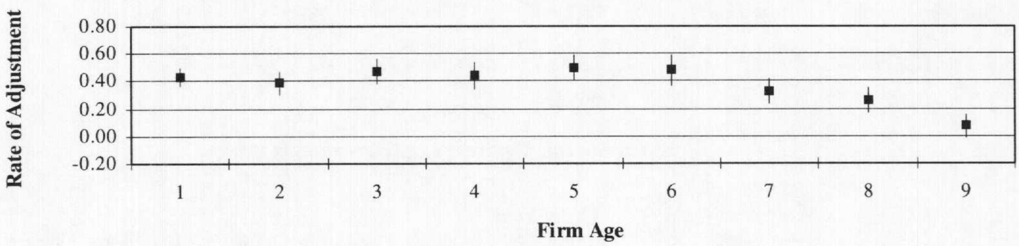
TABLE 4 (Continued)

*, **, *** Indicates explanatory variable coefficient significance at p-values less than 0.10, 0.05, and 0.01, respectively, in two-tailed tests for the regression intercepts and one-tailed tests otherwise (i.e., where directional predictions are made).

This table presents results for changes leverage equations using cross-sectional random coefficient model regressions to examine firms' reversion toward various specifications for their optimal capital structures. The reversion parameters are presented in Panel A, and are the difference between the proxy for firm-specific optimal capital structure and the one-year lag of the firm's debt ratio (see also equation (1)). The firm-specific optimal capital structure proxies are defined as follows. The nine-year time-series mean debt ratio includes all of the firm's first nine years of public operation except for the current year. The three-year historical mean debt ratio is the firm's time-series mean debt ratio for the three years preceding the current year. The three-year lead mean debt ratio is the firm's time-series mean debt ratio for the three years succeeding the current year. The contemporaneous industry-mean debt ratio is the industry-mean debt ratio for the same calendar year of firms in the narrowest SIC code that includes at least five firms after removing the firm under study. All regressions are estimated cross-sectionally for each of firms' first through ninth years of public operation, except for the regressions with the three-year historical mean debt ratio specified as the firm-specific optimal capital structure proxy (column 2), which is estimated cross-sectionally for each of firms' third through ninth public years. For each firm-specific optimal capital structure proxy and the dependent variable, the debt ratio is defined as the book value of short-term and long-term debt divided by the sum of the book value of short-term debt, long-term debt, and shareholders' equity. Firm age is the number of years that have elapsed since the firm's initial public offering. In this table, the subscripts i and t identify firms and time, respectively.

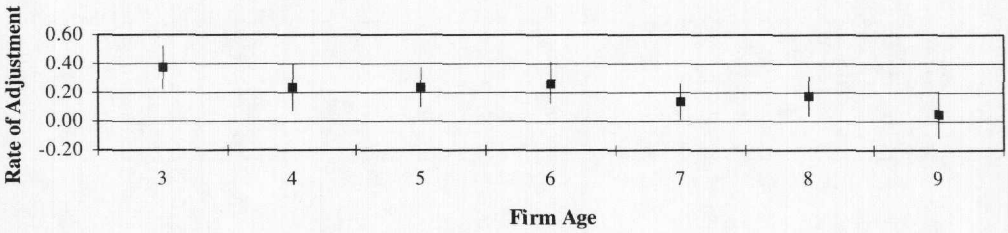
Panel B presents the weighted regression of the coefficients estimates from Panel A on firm age where observations are weighted by the underlying variance of the estimates.

FIGURE 1
TIME-SERIES OF RATE OF ADJUSTMENTS TO TARGET LEVERAGE
(DEFINED AS THE FIRM'S NINE-YEAR TIME-SERIES MEAN DEBT RATIO)



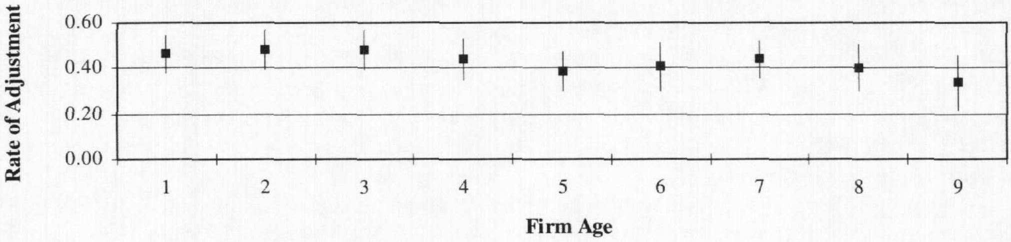
This figure presents the cross-sectional coefficient estimates for firms' first through ninth years of public operation for the rate of adjustment variable, $(1 - \delta)$, in the target adjustment model specified in equation (4.1). The firm's nine-year time-series mean debt ratio, which is defined in Table 3, represents target leverage in this specification. The rate of adjustment coefficient measures the fraction of the distance between actual and target leverage that the firm moved during the year. The squares in this figure indicate the slope coefficients from the nine cross-sectional random coefficients models. Each coefficient estimate is surrounded by a 90 percent confidence interval that is represented by a vertical line.

FIGURE 2
TIME-SERIES OF RATE OF ADJUSTMENT TO TARGET LEVERAGE (DEFINED AS THE FIRM'S THREE-YEAR HISTORICAL MEAN DEBT RATIO)



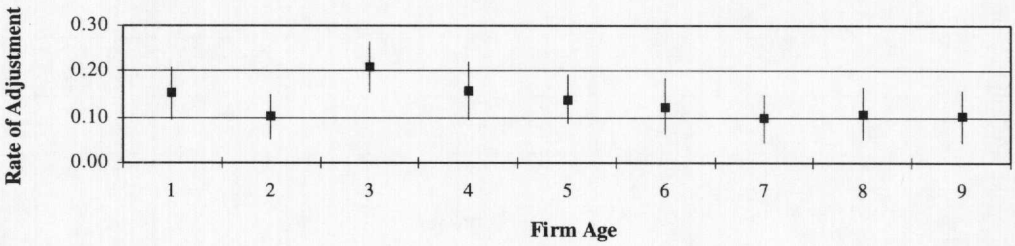
This figure presents the cross-sectional coefficient estimates for firms' third through ninth years of public operation for the rate of adjustment variable, $(1 - \delta)$, in the target adjustment model specified in equation (4.1). The firm's three-year historical mean debt ratio, which is defined in Table 3, represents target leverage in this specification. The rate of adjustment coefficient measures the fraction of the distance between actual and target leverage that the firm moved during the year. The squares in this figure indicate the slope coefficients from the seven cross-sectional random coefficients models. Each coefficient estimate is surrounded by a 90 percent confidence interval that is represented by a vertical line.

FIGURE 3
TIME-SERIES OF RATE OF ADJUSTMENT TO TARGET LEVERAGE (DEFINED AS THE FIRM'S THREE-YEAR LEAD MEAN DEBT RATIO)



This figure presents the cross-sectional coefficient estimates for firms' first through ninth years of public operation for the rate of adjustment variable, $(1 - \delta)$, in the target adjustment model specified in equation (4.1). The firm's three-year lead mean debt ratio, which is defined in Table 3, represents target leverage in this specification. The rate of adjustment coefficient measures the fraction of the distance between actual and target leverage that the firm moved during the year. The squares in this figure indicate the slope coefficients from the nine cross-sectional random coefficients models. Each coefficient estimate is surrounded by a 90 percent confidence interval that is represented by a vertical line.

FIGURE 4
TIME-SERIES OF RATE OF ADJUSTMENT TO TARGET LEVERAGE (DEFINED AS THE CONTEMPORANEOUS INDUSTRY MEAN DEBT RATIO)



This figure presents the cross-sectional coefficient estimates for firms' first through ninth years of public operation for the rate of adjustment variable, $(1 - \delta)$, in the target adjustment model specified in equation (4.1). The contemporaneous industry mean debt ratio, which is defined in Table 3, represents target leverage in this specification. The rate of adjustment coefficient measures the fraction of the distance between actual and target leverage that the firm moved during the year. The squares in this figure indicate the slope coefficients from the nine cross-sectional random coefficients models. Each coefficient estimate is surrounded by a 90 percent confidence interval that is represented by a vertical line.

that firms' debt ratios increase with age consistent with Diamond's (1989, 1991a) theory of reputation formation in capital markets.[19]

This issue is examined with pooled OLS tests that condense the time-series variation in the adjustment process into a single coefficient. In these tests, all firm-year observations are pooled and the age of the firm is included as a primary variable and as an interaction with the reversion parameter, $(1 - \delta)$. Table 5 presents the results of this estimation for the four target proxies. Evidence at p-values under 0.01 supporting the predicted negative time-series variation in the reversion toward target leverage is found for each of the four target proxies.

In these pooled tests, positive regression intercept terms and low explanatory power would be symptoms of the sample being biased by firms operating below their optimal capital structures (Shyam-Sunder and Myers 1999). This appears to be the situation when the three-year historical mean debt ratio and the contemporaneous industry-mean debt ratio are specified to estimate target leverage (columns 2 and 4 in Table 5, respectively). The constant is positive and significant and the adjusted R^2 is low in each case. However, both the nine-year time-series mean debt ratio and the three-year lead mean debt ratio are apparently acceptable target proxies (columns 1 and 3 in Table 5, respectively); i.e., in both cases, the estimated intercept is near zero and the adjusted R^2 is considerably higher.[20]

The pooled tests also provide an opportunity to compare the reversion parameter, $(1 - \delta)$, estimates to extant research on target adjustment models. Table 5 reports the following parameter

[19] Diamond (1989, 1991a) argues that incentive problems in debt markets are worse in firms' early years when they suffer from severe information deficiencies. However, young firms can moderate asset substitution and moral hazard problems by developing a reputation for repaying their debts, which in turn lowers their interest rates and increases credit availability. Diamond (1989, 1991a) models the dynamics of borrowers' incentives with lenders learning over time from observing firms' credit histories. Firms are eager to acquire a reputation for servicing their loans since this asset lowers their cost of capital and reduces credit rationing.

[20] In addition, the year-to-year regressions reported in Table 4 are consistent with the interpretation that the nine-year time-series mean debt ratio and the three-year lead mean debt ratio are better proxies for firm-specific optimal capital structure.

TABLE 5
OLS REGRESSION RESULTS—BALANCED PANEL TESTS OF FIRMS' REVERSION TOWARD VARIOUS PROXIES FOR OPTIMAL CAPITAL STRUCTURE

$$\Delta LEVERAGE_{it} = \alpha + (1 - \delta)\ REVERSION_{it} + \beta_1\ AGE_{it} + \beta_2\ AGE * REVERSION_{it} + \varepsilon_{it}$$

		Firm-Specific Optimal Capital Structure Proxy			
Variable	**Prediction**	**Nine-Year Time-Series Mean Debt Ratio 1**	**Three-Year Historical Mean Debt Ratio 2**	**Three-Year Lead Mean Debt Ratio 3**	**Contemporaneous Industry Mean Debt Ratio 4**
Intercept	?	0.004	0.020***	0.002	0.020***
Reversion parameter	+	0.512***	0.586***	0.452***	0.211***
Firm Age	+	0.001	−0.002**	0.000	−0.001*
Age* Reversion parameter	−	−0.030***	−0.059***	−0.013***	−0.011***
Adjusted R^2		0.137	0.040	0.253	0.055
F-statistic		285.46°	176.98°	286.01°	90.92°
Number of observations		5,391	4,192	2,520	4,626

*, **, *** Indicates explanatory variable coefficient significance at p-values less than 0.10, 0.05, and 0.01, respectively, in two-tailed tests for the regression intercepts and one-tailed tests otherwise (i.e., where directional predictions are made).

Regression equation F-tests significant at less than 0.001 are identified by a ° superscript.

In this table, the subscripts i and t identify firms and time, respectively.

This table presents regression results for changes leverage models using ordinary least squares to examine the reversion toward various specifications of firms' optimal capital structures. The reversion parameter is the difference between the proxy for firm-specific optimal capital structure and the one-year lag of the firm's debt ratio (see also equation (1)). The firm-specific optimal capital structure proxies are defined as follows. The nine-year time-series mean debt ratio includes all of the firm's first nine years of public operation except for the current year. The three-year historical mean debt ratio is the firm's time-series mean debt ratio for the three years preceding the current year. The three-year lead mean debt ratio is the firm's time-series mean debt ratio for the three years succeeding the current year. The contemporaneous industry-mean debt ratio is the industry-mean debt ratio for the same calendar year of firms in the narrowest SIC code that includes at least five firms after removing the firm under study. All regressions include firms' first through ninth years of public operation, except for the regression with the three-year historical mean debt ratio specified as the firm-specific optimal capital structure proxy (column 2), which includes only firms' third through ninth public years. For each firm-specific optimal capital structure proxy and the dependent variable, the debt ratio is defined as the book value of short-term and long-term debt divided by the sum of the book value of short-term debt, long-term debt, and shareholders' equity. Firm age is the number of years that have elapsed since the firm's initial public offering.

estimates for the tests that measure firms' reversion toward the following proxies for their optimal capital structures: 0.512 for the nine-year time-series mean debt ratio; 0.586 for the three-year historical mean debt ratio; 0.452 for the three-year lead mean debt ratio; and 0.211 for the contemporaneous industry-mean debt ratio. In comparison, Jalilvand and Harris (1984, Table II) and Shyam-Sunder and Myers (1999, Table 2) report target adjustment parameter estimates of 0.383 and 0.410, respectively.

The reversion parameter estimates for the sample of firms examined in this study are generally slightly larger than the corresponding estimates provided by previous empirical research. This was expected to occur for at least two reasons. First, Scholes and Wolfson (1989) predict that young firms that have relatively more flexible and less complex capital structures can more quickly adjust to their target leverage.

Second, the sample firms are in their early public years, a period in which they have incentive to frequently change their capital structures. For example, Rajan and Zingales (1998) and Helwege and Liang (1996) provide evidence consistent with the argument that there exists a life cycle in the pattern of corporate financing, with firms relying more on external capital early in their histories to finance their lucrative initial investment projects. Their volatile investment demands may induce these younger firms to adjust their capital structures more often than the mature, stable firms that almost certainly dominate the samples in Jalilvand and Harris (1984) and Shyam-Sunder and Myers (1999).

SENSITIVITY TESTS

This section examines the sensitivity of the reported empirical results, beginning with tests that explore whether extending the panel time-series affects this evidence. Later tests consider whether the observed negative time-series pattern in firms' rate of adjustment to their optimal capital structure persists for a series of respecifications and alternate estimation techniques.

Duration of Panel Time-Series

The regression results presented to this point in the paper involve observing firms through their ninth public year. This research design trades off compiling a sufficiently large balanced panel against having a sufficiently long time-series to test H1. To add a year to the panel, the sample is reduced not only by some firms not surviving another year, but also by entire IPO years being lost. For example, examining firms through their tenth, rather than their ninth, post-issue year would result in the 1988 IPOs being excluded from the sample (see Table 1). However, the evidence supporting the predicted negative time-series variation in firms' rate of adjustment toward their target leverage remains when firms are observed from their first through their 12th public year.

Leverage Specification

In the primary tests, debt is defined as total long-term and short-term debt scaled by the book value of the firm. However, it is prudent to examine whether the results from the random coefficients models, which provide evidence of negative time-series variation in the capital structure adjustment process, is robust to other leverage definitions. For example, Constantinides and Grundy (1989) and Stein (1992) argue that convertible debt provides cost-effective financing when informational asymmetries are relatively severe such as for the young, small firms that are prevalent in the samples in this study. In fact, Helwege and Liang (1996), Mayers (1998), and Krishnaswami et al. (1999) report supporting evidence that firms tend to issue convertible bonds in their early public years.

Accordingly, the numerator of the debt ratio was respecified from the sum of long-term and short-term debt to: (1) the sum of long-term, short-term, and convertible debt; and (2) long-term only. These leverage specifications produce evidence virtually identical to that reported in Figures 1 to 4. In addition, the results were not sensitive to scaling the regression variables with total assets rather than firm book value.

Censorship Bias

Although some of the firm-year observations have no debt in their capital structures, the primary results are from regressions that ignore the potential censorship bias that accompanies treating leverage as a continuous variable.[21] However, qualitatively similar time-series evidence

[21] In each of the samples used to estimate the coefficients graphed in Figures 1 to 4, the fraction of firm-year observations reporting no debt in their capital structures is under the 15–20 percent threshold for which convention suggests the censoring problem might become serious.

obtains when the coefficients are reestimated with cross-sectional tobit regressions to address the dependent variable being left-censored at values of zero.

Unbalanced Panel

The sample selection procedure applied in this study requires nine consecutive years of data (see Table 1), which probably results in removing firms that became severely financially distressed during their early public years. In fact, there is evidence that refinancing costs may affect these firms differently than those in the balanced panel. For example, Gilson (1997) and Frank and Goyal (2000) provide evidence that distressed firms find their capital structures relatively more difficult to adjust.

However, all results reported in this study are robust to the unbalanced sample, which is compiled by discarding only the firm-year that has missing data, rather than the firm's entire time-series. This implies that the screening imposed to compile the balanced panel data does not seriously undermine external validity.

Profitability

Although the firm-specific leverage targets are supposed to capture all determinants of financial policy, we separately examine the potential influence of firms' profitability on the empirical tests for several reasons. Myers (1993) comments that arguably the most pervasive empirical capital structure regularity is the inverse relation between leverage and profitability. In addition, Myers (1984) explains that random events such as unexpected earnings that disturb firms from their optimal capital structure imply that there will be some cross-sectional dispersion in observed debt ratios across a sample of firms having the same target leverage. The typically high correlation between firms' marginal tax rates and their earnings makes this is a particularly important issue for tax research.

Accordingly, we enter a control variable for the change in operating earnings in each of the four regressions that have different target leverage proxies. Notwithstanding that this might corrupt the tests (i.e., primitive influences such as firms' earnings determine the leverage targets), the evidence that firms' capital structures become more constrained over time remains in all regressions when this control is included.

Time-Series Variation in Leverage Adjustment Process—Sample Split on Private Age

The primary research design in this study measures a firm's age as the number of years that have elapsed since its IPO, although firms ordinarily have a private operating history when they go public. This suggests that cross-sectional differences in firms' private ages, defined as the number of years between their incorporation and their IPOs, could affect the tests that estimate the time-series variation in the rate of adjustment toward target leverage.

This issue is evaluated by reexamining the evidence reported in the previous section after bisecting the sample according to firms' median private ages.[22] According to the Scholes and Wolfson (1989) prediction that refinancing costs will accumulate with age, the subsample of older firms, which already have considerable histories at their IPO dates, could have capital structures that are relatively rigid.

Data on firms' private ages were collected from a variety of sources. Professor Jay Ritter of the University of Florida maintains an IPO database that provided the majority of the founding dates for sample firms having their initial public offerings between 1977 and 1984. For the 1985 to 1989 IPOs, *Ward's Business Directory of U.S. Private and Public Companies* was the primary data source. In addition, incorporation dates were found in *Moody's International Manual*, *Moody's Industrial Manual*, *Moody's OTC Industrial Manual*, and *Directory of Corporate Affiliations*.

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[22] The median private age is eight years, measured from year of incorporation to year of initial public offering, and the distribution is highly skewed; e.g., some firms were founded more than 100 years before going public.

The Scholes and Wolfson (1989) argument implies that the financing decisions of the older firms may be more constrained since they already have extensive histories by the time that they go public. However, the mean of their coefficient estimates for the optimal leverage reversion parameter, $(1 - \delta)$, over their first nine public years was generally only slightly larger than that of the subsample of young firms. This result (not tabulated) is found for all target leverage specifications except for the three-year historical time-series mean, for which there is statistically significant evidence that firms older at their IPO dates are slower to adjust to their optimal capital structures in the post-IPO period.

However, this research is more concerned with the evolution in firms' financing decisions in the nine years following their initial public offerings. The earlier tests that examine the time-series variation in firms' rate of adjustment to their targets were rerun on both the young and old firm subsamples.

Using the nine-year time-series mean debt ratio proxy for target leverage, the Pearson correlation between firm age and the reversion parameter estimates, $(1 - \delta)$, is -0.50 and -0.76 for the young and old firm subsamples, respectively. These statistics are respectively significant at the 10 and 1 percent levels in one-tailed tests assuming independence. This statistical significance remains when weighted linear regressions are run to correct for the variable estimation error in the coefficients. This evidence suggests that both young and old firms at their IPO dates experience negative time-series variation in their reversion toward optimal capital structure in their first nine public years.

In fact, similar evidence is found when this estimation procedure is repeated with the other target leverage proxies substituted for L^* in equation (1). Specifically, the reversion parameter coefficients from the year-to-year cross-sectional random coefficients models were separately estimated for the subsamples of young and old firms at their IPO dates. For the following target leverage proxies, these Pearson correlations between the $(1 - \delta)$ coefficients and firm age were observed (one-tailed significance levels after correcting for the coefficient estimation error are in parentheses):

1) -0.85 (1 percent) and -0.70 (5 percent) for the young firms and old firms, respectively, when the three-year historical mean debt ratio represents target leverage;
2) -0.51 (10 percent) and -0.62 (5 percent) for the young firms and old firms, respectively, when the three-year lead mean debt ratio represents target leverage; and
3) -0.44 (not significant) and -0.52 (10 percent) for the young firms and old firms, respectively, when the contemporaneous industry-mean debt ratio represents target leverage.

Although the evidence for negative time-series variation that is observed for the subsample of young firms is slightly weaker and less robust, the target adjustment regressions suggest that both subsamples experience increasing refinancing costs during their first nine public years.

Other Tests

Other respecifications indicate that the results for H1 are not time-period or industry-specific and represent a pervasive economic phenomenon, rather than the data being seriously affected by influential observations or outliers. In addition, the evidence on the evolution in the leverage adjustment process also remains for various diminishing nonlinear transformations of firm age and after removing firms that changed their fiscal year-ends during the nine-year panel (to ensure that the tests are synchronized at one-year intervals).[23] Finally, time-series variation in firms' dependence on external financing is not responsible for the empirical results (Rajan and Zingales 1998).

CONCLUSIONS

This study reports evidence consistent with Scholes and Wolfson's (1989) prediction that refinancing costs that are increasing in age hinder firms from changing their leverage. The target

[23] These nonlinear transformations of firm age include the natural logarithm, the log of one plus age, second-order logs, square roots, and reciprocals.

adjustment model results using various proxies for firm-specific optimal capital structure support their argument that firms' financial policies gradually become more constrained. In fact, the evidence suggests that the duration of firms' private operating histories hardly affects the negative time-series variation observed in firms' reversion toward their target leverage. More specifically, this pattern was detected in both subsamples of young (with one exception) and old firms at their IPO dates.

The target adjustment models measure the fraction of the distance between actual and optimal capital structure that the firm covered during each year in the nine years following their initial public offerings. However, these tests are complicated by difficulty in estimating adequate proxies for firms' target leverage. Although this problem is handled in this study by specifying several alternate proxies, future research could examine the prediction that refinancing costs gradually impede firms' leverage decisions by observing the time-series variation in their reactions to tax incentives.

For example, this research could provide additional evidence on the *dynamic* pattern in refinancing costs by estimating firms' reactions to the *static* incentives available on debt and investment-related tax shields. This empirical design would avoid the complications inherent in attempting to specify proxies for optimal capital structure since the impact of refinancing costs on firms' financial policies could be deduced from their responses to changes in their tax rates. Scholes and Wolfson (1989) predict that as recapitalizing becomes more difficult with age, firms' capital structures will gradually become less sensitive to changes in their marginal tax rates. They also predict that firms increasingly impeded from adjusting their leverage by refinancing costs will begin to shift more toward relying on investment-related tax shields.

Further, tests of the prediction that firm age affects the capital structure adjustment process could be extended to complementary settings such as firms emerging from bankruptcy protection. These newly reorganized firms may resemble recently public firms since they also may not have had the opportunity to accumulate the refinancing costs that increasingly constrain leverage decisions (see Alderson and Betker 1995; Gilson 1997).

REFERENCES

Alderson, M., and B. Betker. 1995. Liquidation costs and capital structure. *Journal of Financial Economics* 39 (1): 45–69.

Asquith, R. Gertner, and D. Scharfstein. 1994. Anatomy of financial distress: An examination of junk bond issuers. *Quarterly Journal of Economics* 109 (3): 625–658.

Auerbach, A. 1985. Real determinants of corporate leverage. In *Corporate Capital Structures in the U.S.*, edited by B. Friedman. Washington, D.C.: National Bureau of Economic Research.

Barclay, M. J., C. W. Smith, and R. L. Watts. 1995. The determinants of corporate leverage and dividend policies. *Journal of Applied Corporate Finance* 7 (4): 4–19.

Beneish, M. D., and E. Press. 1993. Costs of technical violation of accounting-based debt covenants. *The Accounting Review* 68 (2): 233–257.

Berger, A., and G. Udell. 1995. Relationship lending and lines of credit in small firm finance. *Journal of Business* 68 (3): 351–381.

Berlin, M., and L. J. Mester. 1992. Debt covenants and renegotiations. *Journal of Financial Intermediation* 2 (June): 95–133.

Blackwell, D. W., and D. S. Kidwell. 1988. An investigation of cost differences between public sales and private placements of debt. *Journal of Financial Economics* 22 (2): 253–278.

Bolton, P., and D. S. Scharfstein. 1996. Optimal debt structure and the number of creditors. *Journal of Political Economy* 104 (1): 1–25.

Bowen, R., L. Daley, and C. Huber, Jr. 1982. Evidence on the existence and determinants of inter-industry differences in leverage. *Financial Management* 11 (4): 10–20.

Bradley, M., G. Jarrell, and E. Kim. 1984. On the existence of an optimal capital structure: Theory and evidence. *Journal of Finance* 39 (3): 857–877.

Carey, M., S. Prowse, J. Rea, and G. Udell. 1993. The economics of private placements: A new look. *Financial Markets, Institutions, and Instruments* 2 (1): 1–66.

Carter, R., and S. Manaster. 1990. Initial public offerings and underwriter reputation. *Journal of Finance* 45 (4): 1045–1067.

Chaplinsky, S. 1987. The effects of taxes on capital structure. Working paper, University of Michigan.

Chatterjee, S., U. S. Dhillon, and G. Ramirez. 1996. Resolution of financial distress: Debt restructurings via Chapter 11, prepackaged bankruptcies, and workouts. *Financial Management* 25 (1): 5–18.
Chemmanur, T. J., and P. Fulghieri. 1994. Reputation, renegotiation, and the choice between bank loans and publicly traded debt. *The Review of Financial Studies* 7 (3): 475–506.
Chirinko, R. S., and A. R. Singha. 2000. Testing static tradeoff against pecking order models of capital structure: A critical comment. *Journal of Financial Economics* 58 (3): 417–425.
Cole, R. A. 1998. The importance of relationships to the availability of credit. *Journal of Banking and Finance* 22 (6-8): 957–977.
Constantinides, G. M., and B. D. Grundy. 1989. Optimal investment with stock repurchase and financing as signals. *Review of Financial Studies* 2 (4): 445–465.
Datta, S, M. Iskandar-Datta, and A. Patel. 1999. Bank monitoring and the pricing of corporate public debt. *Journal of Financial Economics* 51(3): 435–449.
———, ———, and ———. 2000. Some evidence on the uniqueness of initial public debt offerings. *Journal of Finance* 55 (2): 715–744.
DeAngelo, H., and R. W. Masulis. 1980. Optimal capital structure under corporate and personal taxation. *Journal of Financial Economics* 8 (1): 5–29.
Dennis, W. I., W. C. Dunkelberg, and J. S. Van Hulle. 1988. *Small Business and Banks: The United States*. Washington, D. C.: N. F. I. B. Foundation.
Diamond, D. W. 1989. Reputation acquisition in debt markets. *Journal of Political Economy* 97 (4): 828–862.
———. 1991a. Monitoring and reputation: The choice between bank loans and directly placed debt. *Journal of Political Economy* 99 (4): 688–721.
———. 1991b. Debt maturity structure and liquidity risk. *Quarterly Journal of Economics* 106 (3): 709–737.
Evans, C. 1991. The investment banker's role in the workout process. In *Workouts and Turnarounds*, edited by D. DiNapoli, S. Sigoloff, and R. Cushman. Homewood, IL: Business One Irwin.
Fischer, E., R. Heinkel, and J. Zechner. 1989. Dynamic capital structure choice: Theory and tests. *Journal of Finance* 44 (1): 19–40.
Frank, M., and V. Goyal. 2000. Testing the pecking order theory of capital structure. Working paper, University of British Columbia.
Gertner, R., and D. Scharfstein. 1991. A theory of workouts and the effects of reorganization law. *Journal of Finance* 46 (4): 1189–1222.
Gilson, S. C., K. John, and L. Lang. 1990. Troubled debt restructurings: An empirical study of private reorganization of firms in default. *Journal of Financial Economics* 27 (2): 315–353.
———. 1991. Managing default: Some evidence on how firms choose between workouts and bankruptcy. *Journal of Applied Corporate Finance* 4 (2): 62–70.
———. 1997. Transactions costs and capital structure choice: Evidence from financially distressed firms. *Journal of Finance* 52 (1): 161–196.
Givoly, D., C. Hayn, A. H. Ofer, and O. Sarig. 1992. Taxes and capital structure: Evidence from firms' response to the Tax Reform Act of 1986. *The Review of Financial Studies* 5 (2): 331–355.
Gorton, G., and J. Kahn. 1993. The design of bank loan contracts, collateral and renegotiation. Working paper, National Bureau of Economic Research.
Graham, J. R. 1996. Debt and the marginal tax rate. *Journal of Financial Economics* 41 (1): 41–73.
———, M. L. Lemmon, and J. S. Schallheim. 1998. Debt, leases, taxes, and the endogeneity of corporate tax status. *Journal of Finance* 53 (1): 131–161.
———. 2000. How big are the tax benefits of debt? *Journal of Finance* 55 (5): 1901–1941.
———, and C. R. Harvey. 2001. The theory and practice of corporate finance: Evidence from the field. *Journal of Financial Economics* 60 (2-3): 187–243.
Grossman, S., and O. Hart. 1980. Takeover bids, the free-rider problem and the theory of the corporation. *Bell Journal of Economics* 11 (Spring): 42–64.
Guedes, J., and T. Opler. 1996. The determinants of the maturity of corporate debt issues. *Journal of Finance* 51 (5): 1809–1833.
Gupta, M. C. 1969. The effect of size, growth, and industry on the financial structure of manufacturing companies. *Journal of Finance* 24 (2): 517–529.
Gupta, S., and K. Newberry. 1997. Determinants of the variability in corporate effective tax rates: Evidence from longitudinal data. *Journal of Accounting and Public Policy* 16 (1): 1–34.
Harris, M., and A. Raviv. 1991. The theory of capital structure. *Journal of Finance* 46 (1): 297–355.
Helwege, J., and N. Liang. 1996. Is there a pecking order? Evidence from a panel of IPO firms. *Journal of Financial Economics* 40 (3): 429–458.
———. 1999. How long do junk bonds spend in default? *Journal of Finance* 54 (1): 341–359.

Hildreth, C., and J. Houck. 1968. Some estimates for a linear model with random coefficients. *Journal of the American Statistical Society* 63 (1968): 584–592.

Jain, B. A., and O. Kini. 1994. The post-issue operating performance of IPO firms. *Journal of Finance* 49 (5): 1699–1726.

Jalilvand, A., and R. S. Harris. 1984. Corporate behavior in adjusting to capital structure and dividend targets: An econometric study. *Journal of Finance* 39 (1): 127–145.

James, C., and P. Weir. 1990. Borrowing relationships, intermediation, and the cost of issuing public securities. *Journal of Financial Economics* 28 (1-2): 149–171.

———. 1995. When do banks take equity in debt restructurings? *Review of Financial Studies* 8 (4): 1209–1234.

Krishnaswami, S., P. A. Spindt, and V. Subramaniam. 1999. Information asymmetry, monitoring, and the placement structure of corporate debt. *Journal of Financial Economics* 51 (3): 407–434.

Kwan, S., and W. T. Carleton. 1995. The role of private placement debt issuers in corporate finance. Working paper, Federal Reserve Bank of San Francisco.

Lang, M. 1991. Time-varying stock price response to earnings induced by uncertainty about the time-series process of earnings. *Journal of Accounting Research* 29 (2): 229–257.

Lev, B. 1969. Industry averages as targets for financial ratios. *Journal of Accounting Research* 6 (2): 290–299.

———, and D. Pekelman. 1975. A multiperiod adjustment model for the firm's capital structure. *Journal of Finance* 30 (1): 75–91.

Lummer, S. C., and J. J. McConnell. 1989. Further evidence on the bank lending process and the capital market response to bank loan agreements. *Journal of Financial Economics* 25 (1): 99–122.

MacKie-Mason, J. K. 1990. Do taxes affect corporate financing decisions? *Journal of Finance* 45 (5): 1471–1493.

Marsh, P. 1982. The choice between equity and debt: An empirical study. *Journal of Finance* 37 (1): 121–144.

Masulis, R., and A. Korwar. 1986. Seasoned equity offerings: An empirical investigation. *Journal of Financial Economics* 15 (1-2): 91–118.

Mayers, D. 1998. Why firms issue convertible bonds: The matching of financial and real investment options. *Journal of Financial Economics* 47 (1): 83–102.

Miller, M. 1977. Debt and taxes. *Journal of Finance* 32 (1): 261–275.

Modigliani, F., and M. Miller. 1958. The cost of capital, corporation finance, and the theory of investment. *American Economic Review* 48 (3): 261–297.

———, and ———. 1963. Corporate income taxes and the cost of capital: A correction. *American Economic Review* 53 (3): 433–443.

Myers, S. C. 1977. Determinants of corporate borrowing. *The Journal of Financial Economics* 5 (2): 147–175.

———. 1984. The capital structure puzzle. *Journal of Finance* 39 (3): 575–592.

———, and N. S. Majluf. 1984. Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics* 3 (2): 187–221.

———. 1993. Still searching for the optimal capital structure. *Journal of Applied Corporate Finance* 6 (1): 4–14.

Nakamura, L. 1989. Loan workouts and commercial bank information: Why are banks special? Working paper, Federal Reserve Bank of Philadelphia.

Opler, T. C., and S. Titman. 1996. The debt-equity choice: An analysis of issuing firms. Working paper, Boston College.

Park, C. 2001. Monitoring and structure of debt contracts. *Journal of Finance* 55 (5): 2157–2195.

Parrino, R., and M. Weisbach. 1999. Measuring investment distortions arising from stockholder-bondholder conflicts. *Journal of Financial Economics* 52 (1): 3–42.

Petersen, M. A., and R. G. Rajan. 1994. The benefits of lending relationships: Evidence from small business data. *Journal of Finance* 49 (1): 3–37.

———, and ———. 1995. The effect of credit market competition on lending relationships. *Quarterly Journal of Economics* 110 (2): 407–444.

Pittman, J. A. 2000. Direct tests of Diamond's theory of reputation formation in debt markets. Working paper, Memorial University of Newfoundland.

Preece, D., and D. J. Mullineaux. 1996. Monitoring, loan renegotiability, and firm value: The role of lending syndicates. *Journal of Banking and Finance* 20 (3): 577–593.

Rajan, R. 1992. Insiders and outsiders: The choice between informed and arm's-length debt. *Journal of Finance* 47 (4): 1367–1400.

———, and L. Zingales. 1995. What do we know about capital structure: Evidence from G-7 countries. *Journal of Finance* 50 (5): 1421–1460.

———, and ———. 1998. Financial dependence and growth. *The American Economic Review* 88 (3): 559–586.

Ritter, J. R. 1991. The long-run performance of initial public offerings. *Journal of Finance* 46 (1): 3–27.

Schmidt, R. 1976. Determinants of corporate debt ratios in Germany. In *European Finance Association 1975 Proceedings*. Amsterdam, The Netherlands: North Holland.

Scholes, M. S., and M. A. Wolfson. 1989. Issues in the theory of optimal capital structure. In *Frontiers of Modern Finance*, edited by S. Bhattacharya, and G. Constantinides. New York, N.Y.: Rowman & Littlefield.

———, and ———. 1992. *Taxes and Business Strategy: A Planning Approach*. Englewood Cliffs, NJ: Prentice Hall.

Schwartz, and R. Aronson. 1967. Some surrogate evidence in support of the concept of optimal financial structure. *Journal of Finance* 22 (1): 10–18.

Shevlin, T. 1990. Estimating corporate marginal tax rates with asymmetric tax treatment of gains and losses. *The Journal of the American Tax Association* 12 (1990): 51–67.

———. 1999. Research in taxation. *Accounting Horizons* 13 (4): 427–441.

Shyam-Sunder, L., and S. C. Myers. 1999. Testing static tradeoff against pecking order models of capital structure. *Journal of Financial Economics* 51 (2): 219–244.

Slovin, M. B., M. E. Sushka, and Y. M. Bendeck. 1994. Seasoned common stock issuance following an IPO. *Journal of Banking and Finance* 18 (1): 207–226.

Smith, C. 1977. Alternative methods for raising capital: Rights versus underwritten offerings. *Journal of Financial Economics* 5 (3): 273–307.

———. 1986. Investment banking and the capital acquisition process. *Journal of Financial Economics* 26 (1): 3–29.

Stein, J. C. 1992. Convertible bonds as backdoor equity financing. *Journal of Financial Economics* 32 (1): 3–22.

Stickney, C. P., and V. E. McGee. 1982. Effective corporate tax rates, the effect of size, capital intensity, leverage, and other factors. *Journal of Accounting and Public Policy* 1 (2): 125–152.

Taggart, R. A. 1977. A model of corporate financing decisions. *Journal of Finance* 32 (4): 1467–1484.

Taub, A. 1975. The determinants of the firm's capital structure. *Review of Economics and Statistics* 57 (4): 410–416.

Titman, S., and R. Wessels. 1988. The determinants of capital structure choice. *Journal of Finance* 43 (1): 1–19.