

# Financial Slack and Tests of the Pecking Order's Financing Hierarchy

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# Financial Slack and Tests of the Pecking Order's Financing Hierarchy

## Abstract

We empirically examine the pecking order theory of capital structure, while accounting for the value of financial slack. We begin by developing an empirical model that is motivated by the pecking order's decision rule and implied financing hierarchy. The model addresses the statistical power problem associated with previous empirical tests and enables us to identify those decisions that conform to and those that violate the theory's predictions. We find that the pecking order is unable to explain why firms turn to external capital markets and, conditional on using external funds, why firms choose to issue equity. Of the firm-year observations where firms use external finance (equity), less than 40% (20%) are consistent with the pecking order's prediction. Thus, firms violate the financing hierarchy more often than not and these violations are due neither to time varying adverse selection costs nor debt capacity concerns. When compared to a sample of private borrowers for which we have detailed loan and firm-characteristic information, the majority of equity issuers are not materially different from their counterparts that turn to the private debt market.

The pecking order theory of capital structure, formalized by Myers (1984) and Myers and Majluf (1984), posits that firms have a preference ranking over financing sources because of asymmetric information between managers and investors. Firms work their way up the pecking order to finance investment, beginning with internal funds that avoid adverse selection costs. Any financing deficit is met first with riskless debt, followed by risky debt. Equity, which experiences the largest adverse selection costs, is at the top of the pecking order. When firms have excess cash (i.e., a financing surplus), they pay down any outstanding debt. Thus, imbalances between internal funds and investment needs are met primarily with debt, while equity is viewed as a residual source of financing.

The empirical evidence concerning the pecking order is conflicting, in large part because of statistical power problems. Many papers (e.g., Titman and Wessles (1988), Rajan and Zingales (1995), and Fama and French (2002), among others) cite the negative association between leverage and profitability as evidence consistent with pecking order behavior, and inconsistent with tradeoff behavior in which firms balance the tax benefits and bankruptcy costs associated with debt financing.<sup>1</sup> However, theoretical studies by Hennessy and Whited (2004) and Strebulaev (2004) present dynamic models in which an inverse association between leverage and profitability is, in fact, consistent with traditional tax-bankruptcy cost arguments, once one allows for endogenous investment and/or costly security issuance.

Shyam-Sunder and Myers (1999) conclude that the pecking order offers a good description of financing behavior, after presenting an empirical model in which net financing need is matched approximately dollar-for-dollar by net debt issues in their sample of large firms during the 1970s and 1980s. However, Chirinko and Singha (2000) show that the hypothesis test used by Shyam-Sunder and Myers suffer from statistical power problems that “[raise] serious questions about the validity of inferences based on [their] new testing strategy.” (p. 424) Indeed, a perverse financing hierarchy in which equity is selected before debt can be found consistent with pecking order behavior using the Shyam-Sunder and Myers test if debt is the dominant source of financing. Alternatively, a pecking order financing hierarchy can be rejected if equity financing is allowed to play a large enough role.

More recently, Frank and Goyal (2003) show that when smaller firms and more recent data are included in Shyam-Sunder and Myers’ analysis, the pecking order is rejected. Lemmon and Zender (2003) counter by arguing that in testing the pecking order, one must

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<sup>1</sup>The association is also argued as inconsistent with agency costs of free cash flow (Jensen (1986)) and managerial entrenchment (Zweibel (1996)), and the use of debt as a remediation.

account for the value of maintaining financial slack for future investment and to avoid financial distress. When they do so, Lemmon and Zender conclude that this “modified” pecking order does offer a reasonable description of the financing behavior of Frank and Goyal’s broader sample. However, these extensions to the Shyam-Sunder and Myers model, while providing important insights into corporate capital structure, still suffer from the power problems noted by Chirinko and Singha and as such cannot distinguish pecking order behavior from alternative hypotheses. Thus, whether the pecking order is an appropriate description of observed financing behavior is still an open question, as is the need for a more powerful empirical test.

The goal of this paper is to introduce an empirical model that addresses the power problems encountered by previous empirical work, while also presenting empirical evidence concerning the appropriateness of the pecking order as a descriptor of financing behavior. We begin by developing an empirical model of the pecking order’s financing hierarchy, as an implication of the theory’s decision rule: When investment exceeds internal resources firms turn to external financing, and when investment exceeds firms’ ability to borrow they turn to equity. Despite the centrality of this prediction to the theory, we are unaware of any previous studies that explicitly test this ordering of decisions.<sup>2</sup> We also model the entire hierarchy, internal funds followed by debt and then equity, as well as incorporating the insight of Lemmon and Zender that firms desire financial slack. As a result, our model enables us to examine both the static or strict pecking order, as well as the dynamic or modified version which allows firms to violate the pecking order’s financing hierarchy should concerns over future investment opportunities overwhelm current adverse selection costs.

After developing the model, we perform a simulation experiment to illustrate how our model solves the power problem noted by Chirinko and Singha, whereas the model of Shyam-Sunder and Myers is unable to distinguish between alternative financing behavior. By focusing on the pecking order’s ability to accurately characterize observed financing decisions, our test avoids the pitfalls of the Shyam-Sunder and Myers framework, which cannot detect violations of the financing hierarchy (i.e., ordering of decisions) and implicitly requires that firms issue little equity relative to debt. This assumption, while loosely consistent with the implications of pecking order behavior, is neither a necessary nor a sufficient condition for rejection of the theory, particularly in light of the Lemmon and

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<sup>2</sup>de Haan and Hinloopen (2003) estimate an ordered probit model of financing decisions but ignore the decision rule governing the order. Hence, the ordering implicit in their model could arise for reasons having nothing to do with the pecking order.

Zender study emphasizing the dynamic version of the pecking order. The simulation also provides a quantifiable null hypothesis for which to test our empirical hypotheses. Thus, our tests enable us to answer the question of whether or not firms adhere to the pecking order's financing hierarchy, as well as enabling us to identify the so-called justified violations of the hierarchy due to future investment opportunities and/or debt capacity concerns.

Our results show that firms violate the pecking order's financing hierarchy more often than not. Of the observations where firms use external finance, less than 40% are consistent with the pecking order's prediction. That is, firms appear to have sufficient internal reserves to fund both current and anticipated investment yet still turn to external capital markets for funds. Of the observations where firms use equity financing, less than 20% are consistent with the theory's prediction. That is, despite the ability to fund investment with internal funds or debt, firms turn to equity markets for financing. Interestingly, large firms are more likely to violate the financing hierarchy than are small firms, consistent with Fama and French (2003) but opposite the findings of Frank and Goyal (2003) and Lemmon and Zender (2003). The cause of these seemingly conflicting results is due simply to different empirical approaches. While it is true that firms with greater investment and fewer internal resources are more likely to turn to external finance, the majority of external financings occur despite firms having sufficient funds to cover their current and anticipated investment needs. Similarly, firms are more likely to use equity financing as investment increases and/or cash flow decreases (as found by Lemmon and Zender and Frank and Goyal) but the majority of equity financings occur when firms still have sufficient debt capacity to fill their investment needs (as suggested by Fama and French).

Our results are robust to possibly time-varying information asymmetry costs (see Korajczyk et al. (1990, 1991), Choe et al. (1993), and Bayless and Chaplinsky (1996)). Even during periods of high information asymmetry, the pecking order does poorly in predicting both external and equity financings. Additionally, liquidity and debt capacity concerns do not appear to be the cause of the model's poor performance. When compared to a sample of private borrowers, equity issuers are surprisingly similar along many dimensions but, in particular, along current and anticipated financing deficits. Further analysis reveals that the large majority of equity issuers would face borrowing rates similar to those faced by private borrowers, and those rates are only slightly higher than that found on investment grade public debt. These results are consistent with the survey evidence of Graham and Harvey (2001), who note that "...the desire for financial

flexibility [i.e. the ability to fund investments with internal funds] is not driven by the factors behind the pecking-order theory.” (P. 219)

Our conclusion that the pecking order does not accurately describe financing behavior is also consistent with that of Frank and Goyal (2003), Helwege and Liang (1996) and Fama and French (2003), though our empirical approach and evidence differ in several important respects. First, by using our empirical model, we avoid the power problem faced by Frank and Goyal, who rely on the Shyam-Sunder and Myers framework. Chirinko and Singha’s critique suggests that Frank and Goyal’s rejection of the theory may be due to a relatively larger proportion of equity issuance, as opposed to deviations from the financing hierarchy. Second, our sample period covers 1970 to 2003 and encompasses over 3,000 firms, in comparison to the 367 IPO firms followed by Helwege and Liang from 1984 to 1992. Third, we explicitly address the issue raised by Lemmon and Zender (2003) that firms’ desires for financial slack may compel them to violate the strict financing hierarchy and, as such, this issue must be accounted for in empirical analysis. Neither Frank and Goyal nor Helwege and Liang directly tackle this issue that was raised, in part, in response to these earlier findings. Fourth, we provide direct evidence on the ability of equity issuers to borrow at the time of security choice by examining data on corporate loans, a resource unexploited in this context by previous studies. Finally, we model the entire financing hierarchy and judge the predictive accuracy of the model in light of our benchmark simulation results. Fama and French focus solely on the equity issuance decision, which represent less than 15% of all financing decisions, and present evidence that, while suggestive, is ultimately subjective. In sum, our empirical approach and evidence extend and add to the existing literature examining the empirical validity of the pecking order and raise new questions pertaining to exactly how information asymmetry manifests itself in financing decisions.

The remainder of the paper is as follows. Section I reviews the pecking order theory and discusses the empirical predictions. Section II describes the empirical model. Section III outlines the data and sample selection. Section IV presents the results of our analysis. Section V concludes.

## I. The Pecking Order

### A. Theory

The pecking order of Myers (1984) and Myers and Majluf (1984) is well-known in research on corporate capital structure. As such, we only briefly discuss the theory and its

empirical predictions. At the core of the pecking order is the assumption of asymmetric information between the firm’s well-informed managers and its less-informed investors. Managers use their informational advantage to issue securities when they are overpriced. Aware of management’s incentive, investors discount the price that they are willing to pay for the securities. The result of this discounting is a potential underinvestment problem, as managers forgo profitable investment opportunities.

Since internal funds avoid informational problems entirely, they are at the bottom of the pecking order. When internal funds are insufficient to meet financing needs (i.e., financing deficit), firms turn first to risk-free debt, then risky debt, and finally equity, which is at the top of the pecking order. Any internal funds in excess of financing needs (i.e., financing surplus) are used to repurchase debt, as opposed to equity, because of similar adverse selection problems. Thus, the pecking order theory imposes a strict financing hierarchy: internal funds first, debt second, and equity last.

However, the last section of Myers and Majluf (1984) and the conclusion of Myers (1984) describe a “modified” pecking order that recognizes both asymmetric information and costs of financial distress. This modification allows equity financing to play a more significant role. Firms may issue equity in place of debt or internal financing to maintain both liquid assets and debt capacity for future investments, thereby avoiding potential underinvestment problems and lowering expected bankruptcy costs. Thus, the modified pecking order relaxes the strict dollar-for-dollar matching of debt with net financing need by allowing the use of equity when firms desire financial slack for future investment, or when debt issuance would place the firm under financial duress.

### *B. Empirical Predictions*

Figure 1 illustrates the intuition and empirical implications of the (modified) pecking order. Beginning with Panel A, firms finance current investment with internal resources up to the cash threshold  $C^*$ , which represents the amount of internal funds that the firm has available for investment. This threshold accounts for more than just the total amount of internal resources but also the value of retaining some fraction of those resources. More specifically, if the firm values maintaining positive cash balances, as suggested by previous studies on corporate cash holdings (e.g., Opler et al. (1999) Kim, Mauer and Stohs (1998), Faulkender and Wang (2004), and Pinkowitz and Williamson (2004)) and survey evidence (e.g., Graham and Harvey (2001)), then  $C^*$  represents only a fraction of the firm’s internal resources. This fraction is determined by weighing the costs and

benefits associated with maintaining cash (or cash-like) securities within the company and is discussed in more detail below when we develop our empirical model.

When the size of current investment exceeds  $C^*$ , the firm then turns to external financing to fill the financing deficit. Debt financing is applied first and used up to the point  $D^*$ , where  $(D^* - C^*)$  represents the firm's debt capacity or the amount of debt the firm can undertake without jeopardizing its financial health or future investment opportunities. The debt threshold  $D^*$  is determined by weighing the costs and benefits associated with external financing sources (debt and equity), much like the determination of  $C^*$ . Only when current investment outstrips the threshold  $D^*$  does the firm turn to equity financing. Thus, Panel A illustrates both the traditional financing hierarchy and the dependence of that hierarchy on the thresholds  $C^*$  and  $D^*$ .

We note that if one allows for transaction costs, then the number of financing decisions may be affected, though the financing hierarchy and, consequently, the empirical implications, are not. As Stafford (2001) shows, cash balances tend to increase after large investments, consistent with firms substituting capital raising funds for internal funds. Thus, rather than exhausting internal resources before turning to external capital markets, firms may simply go directly to external capital markets to finance all of their investment demand with debt if investment is greater than  $C^*$  but less than  $D^*$ , or entirely with equity if investment is greater than  $D^*$ . Regardless, the empirical implications under this alternative structure are unaffected: firms avoid external capital when investment is less than  $C^*$  and equity capital when investment is less than  $D^*$ .

While Panel A depicts the pecking order as it is most often viewed, Panels B and C illustrate two ways in which the financing hierarchy can be changed when allowing for the value of maintaining financial slack. Panel B shows a negative  $C^*$ , implying that the firm has less cash than it would like. Though the firm may still have cash on hand, it will issue debt first to fund current investment and possibly replenish cash reserves. If current investment outstrips  $D^*$ , equity financing is required. Panel C illustrates a  $D^*$  that is less than  $C^*$ , implying a negative debt capacity. In this situation, the firm can use internal funds to pay down their debt or go straight to equity financing to replenish (or stock-pile, as termed by Lemmon and Zender (2003)) their debt capacity, depending on the size of current investment. Thus, Panels B and C show that empirically testing the pecking order requires estimates of the thresholds  $C^*$  and  $D^*$ , as it is otherwise impossible to know which financing decisions firms should be making.

## II. The Empirical Model

As described above, the pecking order's financing hierarchy implies a decision making process uniquely determined by the relationship between investment and the thresholds  $C^*$  and  $D^*$ . The first decision that firm  $i$  makes in period  $t$  is between internal and external funds,  $External_{it}$ , and is determined by the relative magnitudes of investment ( $Inv_{it}$ ) and  $C_{it}^*$ .<sup>3</sup> When current investment is less than the available internal resources, the firm chooses to finance its investment solely with cash and liquid assets. This decision is represented mathematically as

$$External_{it} = \begin{cases} 1 & Inv_{it} > C_{it}^* \\ 0 & \text{otherwise} \end{cases} \quad (1)$$

The second decision facing the firm is whether to use debt or equity. This decision is determined by the relative magnitudes of investment,  $C_{it}^*$ , and  $D_{it}^*$ . When current investment exceeds  $C_{it}^*$ , so that the firm has decided to use external finance, but is less than  $D_{it}^*$  then the firm uses debt financing. When investment outstrips the firm's debt threshold (i.e. greater than  $D_{it}^*$ ), then the firm turns to equity financing. This decision is represented mathematically as

$$Equity_{it} = \begin{cases} 1 & Inv_{it} > D_{it}^* \\ 0 & C_{it}^* \leq Inv_{it} < D_{it}^* \end{cases} \quad (2)$$

The remainder of this section details the specification of the thresholds and compares the model to those found in previous studies. We then perform a power study to highlight how the model can distinguish pecking order behavior from the alternatives identified by Chirinko and Singha (2000), where as the Shyam-Sunder and Myers model cannot.

### A. The Available Cash Threshold ( $C^*$ )

The available cash threshold ( $C_{it}^*$ ) is defined as:

$$C_{it}^* = CashBal_{it-1} + CashFlow_{it} - CashTarget_{it}^* \quad (3)$$

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<sup>3</sup>We follow previous studies (Shyam-Sunder and Myers (1999) and Frank and Goyal (2003)) and measure investment as the sum of capital expenditures, increase in investments, acquisitions, and other use of funds, less the sale of PPE (plant, property and equipment), and the sale of investment. As an alternative measure, we include the change in inventory as part of investment to account for the possibility that investment among some firms (e.g., small firms) may be directed more towards working capital, as opposed to capital accumulation. This alternative definition has no affect on our results and is not presented.

where  $CashBal_{it-1}$  is the firm's stock of cash and liquid assets at the end of period  $t - 1$ ,  $CashFlow_{it}$  is the after-tax earnings, net of dividends, of the firm during period  $t$  and  $CashTarget_{it}^*$  is the firm's target level of cash and liquid assets at the end of period  $t$ . We define the stock of cash and liquid assets as the sum of cash and marketable securities, inventories, and accounts receivable.<sup>4</sup> For the purpose of estimation, all variables are scaled by the book assets of the firm as of the end of the previous fiscal year to control for scale effects and mitigate heteroscedasticity. In order to limit potential endogeneity issues, we require all determinants of the financing choice to be in the manager's information set at the beginning of year  $t$ . Therefore, rather than use observed year  $t$  cash flows, we construct an expected cash flow for each year, defined as the average cash flow growth rate over the previous three years applied to the previous year's cash flow.<sup>5</sup>

Equation (3) shows that a firm has available internal resources for investment if the sum of last period's cash balance and the current period's cash flow are greater than the target level of cash balances at the end of the period. As noted earlier, a negative value for  $C_{it}^*$  suggests that the existing cash balance and current cash flows are insufficient to meet their targeted cash balance so that there are no *available* internal funds for investment (i.e., the firm is cash constrained). The first two variables are observable in the data; the cash target is not. Thus, we turn to the literature on corporate cash holdings to aid in specifying the determinants of this variable.

Several studies (see, for example, Kim et al. (1998) and Opler et al. (1999)) argue that firms have an optimal cash level that balances the marginal costs and benefits of holding cash. The costs include a lower rate of return due to a liquidity premium and possible tax disadvantage. The benefits include the avoidance of transaction costs and other external financing costs, such as asymmetric information. Additionally, existing financial agreements, such as public debentures or private loans, may require (implicitly or explicitly) a minimum level of cash. Many debt agreements contain restrictions on additional external financing, thereby necessitating the use of internal funds for debt repayment (see Bradley and Roberts (2003)). As a buffer against cash flow variation, firms may find it cost effective, relative to asset liquidation, to maintain a certain amount of liquid assets. Finally, Kalay (1982) shows that many firms maintain cash reservoirs when confronted with dividend restriction covenants in an effort to avoid overinvestment.

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<sup>4</sup>When we examine our alternative measure of investment that includes changes in inventory, we exclude inventory from this measure.

<sup>5</sup>We also perform our analysis using a narrower definition of cash balances (cash and marketable securities), as well as using realized year  $t$  cash flow. Our results are not materially affected by these changes.

These arguments suggest that cash balances may vary because of active cash management. As such, we specify the cash target as:

$$CashTarget_{it}^* = X_{it-1}\beta + \varepsilon_{it} \quad (4)$$

where  $\beta$  is a vector of unknown parameters,  $X_{it-1}$  is a vector of observed covariates lagged one period to mitigate any potential endogeneity problems, and  $\varepsilon_{it}$  is a mean zero normal random variable assumed to be independent across firms but correlated within firm observations.

Since our focus here is not on the determinants of corporate liquidity per se, we only briefly discuss the variables and their motivation, referring the reader to the aforementioned studies for more detail. Firm size, as measured by the log of book assets, is used by Kim et al. to proxy for external financing costs and Opler et al. to capture economies of scale in cash management. The market-to-book ratio, defined as the ratio of total assets minus book equity plus market equity to total assets, proxies for growth opportunities. While we, like many previous studies (e.g., Titman and Wessels (1998), Kim et al. (1998), Opler et al. (1999) and others) use the market-to-book ratio to measure investment opportunities, it is a less than perfect proxy (see Erickson and Whited (2000)). As such, we include two additional measures of future investment opportunities: research and development expenditures and a forward looking measure of anticipated investment, which we measure with the average of actual investment over the next two years:  $t + 1$  and  $t + 2$ .<sup>6</sup> We similarly define a forward looking measure of anticipated cash flows to capture expected profitability. Assuming firms are rational, these forward looking averages should represent a reasonable approximation of anticipated investment needs and profitability.<sup>7</sup>

We measure cash flow volatility by the historical standard deviation (using data during the previous 10 years, as available) of the ratio of EBITDA to total assets. Leverage is measured by the ratio of total debt (long term plus short term) to total assets. We also examine a measure of market leverage whose denominator is the sum of total debt and market equity but this has no consequences for the results and is not presented. Unlevered Altman's Z-score, defined as the sum of 3.3 times earnings before interest and

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<sup>6</sup>We assume that missing values for the research and development variable are zero, and include a dummy variable equal to 1 for firms with zero or no reported R&D, similar to other studies such as Fama and French (2002) and Kayhan and Titman (2003).

<sup>7</sup>Excluding these forward-looking measures from the specification has little effect on the results, as does replacing them with one-period forecasts from an AR(1) model.

taxes plus sales plus 1.4 times retained earnings plus 1.2 times working capital divided by book assets, is used to proxy for the likelihood of financial distress, as in previous studies by Mackie-Mason (1990) and Graham (1996). Given our broad definition of cash and marketable securities, net working capital represents primarily short-term liabilities and is defined as other current assets minus total current liabilities net of short term debt.

Several fixed effects are included in the model, beginning with a binary indicator for whether or not the firm paid a dividend in year  $t - 1$ . This measure is intended to capture precautionary savings motives for the firm's payout policy, as well as possible financial constraints.<sup>8</sup>

### B. The Debt Threshold ( $D^*$ )

It is conceptually easier to focus on modeling a firm's debt capacity ( $D_{it}^* - C_{it}^*$ ), as opposed to the debt threshold ( $D_{it}^*$ ), which aggregates available cash and debt capacity. Thus, we rewrite equation (2) as:

$$Equity_{it} = \begin{cases} 1 & Inv_{it} > C_{it}^* + DC_{it}^* \\ 0 & C_{it}^* < Inv_{it} \leq C_{it}^* + DC_{it}^* \end{cases} \quad (5)$$

where  $DC_{it}^* = (D_{it}^* - C_{it}^*)$  is the firm's debt capacity in period  $t$ . We specify debt capacity as:

$$DC_{it}^* = MaxDebt_{it}^* - Debt_{it-1} \quad (6)$$

where  $Debt_{it-1}$  is the total debt of the firm outstanding at time  $t - 1$  and  $MaxDebt_{it}^*$  is the maximum amount of debt the firm can issue before exhausting its debt capacity. Thus, debt capacity is the maximum amount of debt the firm can, or is willing to, issue today conditional on any existing debt. And, as before, we scale all variables by the book assets of the firm as of the end of the previous period to control for scale effects and mitigate heteroscedasticity.

Similar to Lemmon and Zender (2003), we parameterize a firm's debt capacity, equivalently  $MaxDebt_{it}^*$ , in terms of firm-specific, industry, and macroeconomic characteristics. As with the cash target, we begin with a linear specification:

$$MaxDebt_{it}^* = Z_{it-1}\gamma + \eta_{it} \quad (7)$$

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<sup>8</sup>Almeida, Campello and Weisbach (2003) and Faulkender and Wang (2004) use the ratio of total dividends plus repurchases to earnings as a proxy for financial constraints.

where  $\gamma$  is a vector of unknown parameters,  $Z_{it-1}$  is a vector of observed covariates lagged one period to mitigate any potential endogeneity problems, and  $\eta_{it}$  is a normal random variable assumed to be independent across firms but correlated within firm observations and contemporaneously correlated with  $\varepsilon_{it}$ . The correlation between the errors in equations (4) and (7) is economically important as the available cash and debt capacity of a firm are almost surely linked. This correlation is also statistically important, as it requires equations (1) and (10) be estimated simultaneously, as opposed to independently from one another, to avoid biasing the parameter estimates.

Drawing on the existing capital structure literature, our specification of the covariates overlap largely with those in the cash target model. Firm size, anticipated investment, anticipated cash flows, cash flow volatility, R&D expenditures, market-to-book, Altman's Z-score and an indicator for dividend paying firms are all included in the vector  $Z_{it}$ . Additionally, we incorporate a measure of tangibility (the ratio of physical plant, property and equipment to total assets) to capture the ability of firms to secure physical assets in order to reduce the cost of debt capital. We also include a proxy for the age of the firm, defined as in Lemmon and Zender (2003) as the amount of time that the firm has been listed on Compustat. Finally, we include year and industry (2-digit SIC level) binary variables to account for any longitudinal or industry fixed effects.<sup>9</sup>

### C. Some Comments Concerning the Model

Substituting equations (3) and (4) into equation (1) reveals that the decision between internal and external funds is governed by the following relation:

$$External_{it} = \begin{cases} 1 & y_{1it}^* > 0 \\ 0 & y_{1it}^* \leq 0 \end{cases} \quad (8)$$

where

$$y_{1it}^* = Inv_{it} - CashBal_{it-1} - CashFlow_{it} + X_{1it-1}\beta_1 + X_{2it-1}\beta_2 + \varepsilon_{it} \quad (9)$$

Substituting equations (3), (4), (6), and (7) into equation (10) reveals that the decision between debt and equity is governed by:

$$Equity_{it} = \begin{cases} 1 & y_{2it}^* > 0 \\ 0 & y_{2it}^* \leq 0 \end{cases} \quad (10)$$

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<sup>9</sup>Though Mackay and Phillips (2004) note that most variation in debt-equity ratios is firm-specific, there is still a significant amount of residual variation at the industry level.

where

$$y_{2it}^* = [Inv_{it} - CashBal_{it-1} - CashFlow_{it} + Debt + X_{1it-1}\beta_1 + X_{2it-1}(\beta_2 - \gamma_1) - X_{3it-1}\gamma_2 + \omega_{it}] \quad (11)$$

and  $\omega_{it} = \varepsilon_{it} - \eta_{it}$ . For identification purposes, we assume that the variance of  $\varepsilon$  is unity, so that all coefficients are implicitly in  $\sigma_\varepsilon$  units. This is a standard identifying restriction in discrete choice models and is innocuous as the observable data is governed only by the sign of  $y_1^*$  and not the magnitude. However, because of the cross-equation restrictions imposed by  $\beta_2$ , we are, in fact, able to identify the scale term associated with  $\omega$ , namely  $\sigma_\omega$ . Appendix A derives the likelihood function.

Equations (8) through (11) specify a partially observed (or censored) bivariate probit. The censoring is due to the unobservability of the decision between debt and equity if the firm chooses to use only internal funds. While the Appendix A details the estimation procedure, we make several comments concerning the model. First, since  $CashTarget^*$  and  $MaxDebt^*$  are not observable, we can not directly estimate equations (4) and (7). Rather, the coefficients of these equations are attained from the bivariate probit estimation. That is, given the pecking order's decision rule, and our specifications for  $CashTarget^*$  and  $MaxDebt^*$ , our model finds those parameter values that best match the observed financing decisions with those predicted by the pecking order. This methodology has the advantage of not introducing additional error through a first-stage estimation of the cash and debt thresholds.

Second, the specification is flexible enough to capture the spirit of the modified pecking order by allowing firms to issue debt despite having internal resources or issue equity sooner than anticipated by the strict pecking order. That is, the model allows for violations of the strict financing hierarchy should future investment opportunities, debt capacity concerns and/or future adverse selection costs, as captured by the thresholds  $C^*$  and  $D^*$ , exceed current adverse selection costs. For example, consider the situation in Panel B of Figure 1, where the firm has a negative cash threshold, implying that its internal resources are less than it desires. Such a situation might arise due to a negative shock to cash flows or greater anticipated growth. Rather than exhausting the internal resources that it has, as the strict pecking order would predict, the model predicts that this firm would turn immediately to the external capital markets. Similarly, in Panel C of Figure 1 the firm has a negative debt capacity, implying that it is overlevered. This situation may arise from a negative equity shock, for example. If investment outstrips  $C^*$ , and consequently  $D^*$ , the model predicts that the firm will turn directly to equity

without first issuing debt. Thus, in so far as the thresholds  $C^*$  and  $D^*$  capture firms' desires for financial slack and the costs associated with different forms of financing, we see that this specification coincides with the financing hierarchy implied by the pecking order, while simultaneously allowing for the dynamic considerations raised by Lemmon and Zender (2003).

Third, the model differs from the multinomial logit specifications found in Helwege and Liang (1996) and Chen and Zhao (2004), which do not model the pecking order's financing hierarchy. That is, there is no sense of "order" among the financing decisions in their models. Further, their specifications ignore the pecking order's decision rule in determining why firms make various financing decisions. In other words, the decision to issue debt or equity in these models is not governed by the relation between investment and available internal resources or debt capacity, as in equations (1) and (10). Rather, the multinomial logit simply compares the relative likelihoods of using different sources, as do other discrete choice models focusing on the debt-equity choice (e.g. Hovakimian, Opler and Titman (2001) and Korajczyk and Levy (2003)).<sup>10</sup> While these previous models can tell us what types of firms tend to make certain financing decisions, they are silent on when and why those decisions are made: precisely the issues on which the pecking order speaks most clearly. Additionally, under the null of the pecking order, firms that access external capital markets are fundamentally different than those that do not; i.e., they are cash constrained. This dependence is assumed away by the i.i.a. assumption of multinomial and conditional logit models, thereby ignoring any sample selection bias.

Finally, our model solves the statistical power problem associated with the Shyam-Sunder and Myers (1999) regression framework. By focusing on the ordering of financing decisions, as opposed to the proportions of debt and equity issuances, we are able to avoid the problems with their framework, as noted by Chirinko and Singha (2000). We highlight the power problem and our solution by way of a power study.

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<sup>10</sup>Multinomial models place other, unnecessary restrictions on the data that are avoided in our bivariate framework. The multinomial logit requires that the data be firm specific (i.e., the same variables affecting the cash threshold also affect the debt capacity, and vice versa). The conditional logit, instead, assumes that the data are choice specific but then requires that the marginal affect of each covariate is the same across alternatives. Both models require the independence of irrelevant alternatives (i.i.a.) property, which Gomes and Phillips (2004) show does not hold among financing decisions. Consequently, a multinomial or conditional logit is simply inappropriate for our purposes.

#### *D. Statistical Power and Previous Empirical Research*

This section discusses the statistical power of our model relative to that used in recent empirical studies, such as Shyam-Sunder and Myers (1999), Frank and Goyal (2003) and Lemmon and Zender (2003). (Details of the simulation are presented in Appendix B.) Statistical power is an important issue because, as Chirinko and Singha (2000) note, the tests used in these earlier studies can produce both false positives and false negatives. Though Chirinko and Singha identify the power problem, they do not propose a solution. As such, we present a simple simulation experiment that highlights how the model presented above is able to address the power problem by distinguishing between pecking order and non-pecking order behavior, at least in the example put forth by Chirinko and Singha. Additionally, our simulation results will provide a quantitative benchmark for the analysis below.

Our simulation begins by generating a sequence of investment data ( $Inv_{it}$ ), cash thresholds ( $C_{it}^*$ ) and debt thresholds ( $D_{it}^*$ ) corresponding to 100 years of data for 1,000 firms. We then identify financing choices using the pecking order decision rule, by examining the relation among  $Inv_{it}$ ,  $C_{it}^*$ , and  $D_{it}^*$ . That is, firm  $i$  in period  $t$  finances investment with internal funds if investment is less than  $C_{it}^*$ , with debt if investment is greater than  $C_{it}^*$  but less than  $D_{it}^*$ , and with equity if investment is greater than  $D_{it}^*$ . We also choose the parameters of the simulation so that the ratio of internal to external and debt to equity decisions match those found in the data, as indicated below in Table III.

In tandem, we take the simulated data and use a random decision rule that ignores the financing hierarchy implied by the pecking order, but still respects the observed ratios of internal to external and debt to equity decisions. Panel A of Table I summarizes the prediction accuracy of the estimated model using both sets of data and highlights the differences between the two. The percentages indicate the fraction of observations relying on internal, debt, or equity financing that are correctly predicted by the model. For example, of the firm-years relying solely on internal funds, the model estimated using the pecking order data accurately predicts this decision 93.6% of the time, while the model estimated using the random data is correct only 57.3% of the time. Of the firm-years for which external financing is used, we see a sharper contrast. The accuracy rates are 89.4% for the pecking order data and 43.0% for the random data. Thus, when the data are generated only by a desire to maintain a fixed proportion of debt and equity, for example, the model overpredicts the use of internal funds. As such, the accuracy rate of predicting the use of internal funds appears relatively high, but at the expense of failing to explain why firms turn to external capital markets: a key motivation of the

pecking order theory. Similar results are found in the decision between debt and equity. The model accurately predicts the use of debt and equity 89% and 77% of the time when estimated with the data generated by the pecking order. With the randomly simulated data, however, the model cannot distinguish between debt and equity decisions so that the accuracy rate for predicting debt (equity) decisions is only 56% (44%), roughly equal to the fraction of debt (equity) decisions among external financing decisions.

Turning to the empirical framework put forth in Shyam-Sunder and Myers (1999), their model is:

$$\Delta Debt_{it} = \alpha + \beta FinDef_{it} + \varepsilon_{it}, \quad (12)$$

where  $FinDef_{it}$  is net financial need or the “financing deficit”, defined as:<sup>11</sup>

$$FinDef_{it} = Dividends_{it} + Inv_{it} + \Delta WorkingCapital_{it} - CashFlow_t. \quad (13)$$

Inspection of equation (12) reveals that it is simply a rearrangement of the flow of funds identity, where the change in equity is treated as the residual ( $\varepsilon_t$ ). The strict pecking order hypothesis implies that  $\alpha = 0$  and  $\beta = 1$ , so that debt changes dollar-for-dollar with the financing deficit. In their analysis of 157 firms that traded continuously from 1971 to 1989, Shyam-Sunder and Myers find that the intercept is economically small and the slope, though statistically different from one, is economically close. They conclude that the pecking order offers an “excellent first-order descriptor of corporate financing behavior, at least for our sample of mature corporations.” (P. 242)

In order to estimate equation (12), we compute the change in debt, change in equity and financing deficit implied by each sequence of simulated financing decisions. The details of these calculations are discussed in Appendix B. The results of estimating the Shyam-Sunder and Myers regression are presented in Panel B of Table I and yield results consistent with the discussion in Chirinko and Singha (2000). More specifically, the regression is unable to distinguish between data generated according to the pecking order and data generated randomly but constrained to maintain a fixed proportion of debt and equity issuances. Thus, by modeling the actual decision making process, as opposed to the relative magnitude of debt issuances, our empirical model provides a more powerful means of testing the pecking order, enabling us to directly address the issue raised by Chirinko and Singha (2000).

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<sup>11</sup>Shyam-Sunder and Myers (1999) also include the current portion of long-term debt, beyond its role in the change in working capital. Estimation of equation (12) is carried out after normalizing the change in debt and financing deficit by book assets.

### III. Data and Summary Statistics

#### A. Sample Selection

For consistency with previous studies and the broadest coverage, our data are drawn from firms on both the CRSP and annual Compustat databases over the period 1971-2001. We exclude financial firms (SIC codes 6000-6999) and utilities (SIC codes 4900-4999) to avoid capital structures governed by regulation. In line with previous capital structure studies, we trim the upper and lower 1% of each variable to mitigate the impact of data errors and outliers. We also restrict leverage measures to lie in the unit interval and the market-to-book ratio to be less than 20.

Several studies of capital structure impose a minimum size threshold for sample selection to avoid dealing with issues related to financial distress. We choose not to exclude these firms for two reasons, although our results are unchanged if we do impose such a restriction. First, a small asset base or low sales could simply reflect a small firm, as opposed to a distressed firm. Second, removing firms based on financial distress potentially excludes observations for which there is a great deal of information. Further, if the financing behavior of these excluded firms is systematically related to the factors in our study, their exclusion can lead to potential biases in the results. The final sample consists of 29,325 firm-year observations, with nonmissing data for all of the variables of interest.

#### B. Identifying Financing Decisions

Our construction of  $External_{it}$  and  $Equity_{it}$  is motivated by previous studies such as Hovakimian (2004), Hovakimian et al. (2001), Korajczyk and Levy (2003), and Leary and Roberts (2003), who identify financing decisions by the relative changes in debt and equity. More specifically, a debt issuance is defined as a net change in total debt from period  $t - 1$  to  $t$ , normalized by book assets in period  $t - 1$ , in excess of 5%. Total debt is defined as the sum of short-term and long-term debt. While there may be instances of misclassification using this scheme, such as when convertible debt is called, the previous studies employing this scheme have shown that their analysis is unaffected by using the SDC database to classify issuances. More importantly, this scheme enables us to identify private debt issuances, which represent the most important source of funds for firms (see Houston and James (1996)).

While these previous studies define equity issuances using the statement of cash flows, namely, the sale of common and preferred stock during period  $t$  in excess of 5% of book

assets in period  $t - 1$ , a recent paper by Fama and French (2003) points out a potential shortcoming of this classification. Fama and French argue that firms often issue equity through channels that may not affect the cash flow of the firm (e.g., employee stock options, grants and stock mergers) and, as such, will not be captured by the cash flow measure. As an alternative, they suggest that net equity issuances be defined as the change in the market value of common equity, adjusted for capital gains.<sup>12</sup> For robustness we perform all of our analysis using both the statement of cash flow definition and Fama and French's definition in conjunction with the 5% cutoff. The results are qualitatively very similar and as such we present those obtained using Fama and French's measure of equity issuances.

While Fama and French do not specify a positive cutoff, that is an equity issuance is defined as any positive change in their measure no matter how small, Table II highlights why we choose strictly positive cutoffs. The majority of changes in equity are a very small fraction of total assets. Many of these issuances likely correspond not to investment financing but, rather, employee stock grant programs or employee stock option exercises. Though technically stock issuances, we believe that these events are not in the spirit of the pecking order, which is motivated by the financing of investment. Further, these events, being so small, may not be subject to significant adverse selection costs. A similar argument applies to debt issuances. Regardless, in unreported analysis, we include all positive changes in defining debt and equity issuances (i.e., a 0% cutoff), as well as changes in excess of 3% of book assets. Our results are only moderately affected and suggest that firms violate the financing hierarchy even more often than when we focus on larger issuance sizes.

If a firm issues neither debt nor equity, the firm is assumed to have used internal resources to fund investment, if any. We also split the relatively few dual issuances into two observations corresponding to two separate, though statistically dependent, decisions: a debt issuance and an equity issuance.

Table III presents summary statistics of financing decisions for our sample of firms. Consistent with the aggregate implications of the pecking order, the majority (62%) of financing decisions make use of only internal funds, followed by debt issuances (22.5%) and finally equity issuances (9.7%). Dual issuances represent a small minority (5.5%). Also presented are average firm characteristics associated with different financing events,

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<sup>12</sup>More specifically, net equity issued is defined for year  $t$  as the product of (1) the split-adjusted growth in shares and (2) the average of the split adjusted stock price at the beginning and end of the fiscal year, where both terms are obtained from Compustat data.

which are broadly consistent with previous empirical findings in studies such as Titman and Wessels (1988), Rajan and Zingales (1995) and Lemmon and Zender (2003). Smaller firms, younger firms and firms with greater book leverage, more cash flow volatility, more growth opportunities and less asset tangibility rely more heavily on equity financing. Greater current and expected future investment results in a greater propensity to turn to external capital markets: both debt and equity. Overall, these results are reassuring in the sense that our sample selection and variable construction enable us to reproduce general results found in previous studies.

## IV. Results

Our results are presented in the following four subsections. First, we examine the significance and direction of association between the covariates and cash targets (and debt capacity) to determine if they are consistent with the theoretical predictions. We view this as a necessary, but not sufficient, condition for the appropriateness of the pecking order as an explanation for observed financing behavior. At a minimum, we would expect economically consistent relations. Second, using the simulation results presented earlier as a benchmark, we examine how closely actual financing decisions coincide with the financing decisions predicted by the model. We view prediction accuracy as a sufficient condition for the pecking order to be a reasonable description of financing behavior since it directly addresses the issue of whether or not firms are following the implied financing hierarchy, and, if they are not, any violations are due to liquidity concerns, debt capacity concerns or large anticipated investment. Third, we address the issue of time varying adverse selection costs, beyond that explicitly included in the model. Papers by Choe et al. (1993) and Bayless and Chaplinsky (1996), for example, argue that time-variation in these costs has important theoretical and empirical implications for the pecking order. Finally, we take a closer look at debt capacity concerns, again beyond that explicitly incorporated in the model, by comparing equity issuers to a large sample of borrowers in the private debt market. With this analysis, we can address the issue of whether equity issuers could have reasonably entered into a debt agreement, as opposed to resorting to equity financing.

### *A. Determinants of Cash Targets and Debt Capacities*

Table IV presents the estimated coefficients for the cash target model in Panel A and the maximum sustainable debt (or debt capacity) in Panel B. Corresponding t-statistics,

adjusted for clustering at the firm level, are also presented. Before discussing the estimated coefficients, we note that the marginal impact measured by  $\beta$  is on the cash target,  $CashTarget_{it}^*$ . The impact on the cash threshold,  $C^*$ , may be found by taking the negative of the coefficient, as is evident from equation (3). Additionally, we note that the estimated coefficients are driven by the model's attempt to find cutoffs or breakpoints that separate financing decisions, as opposed to partial correlations with cash balances or leverage that result from standard linear regressions examining the determinants of these two variables. (See Kim et al. (1998) and Opler et al. (1999) for examples of the former, and Titman and Wessels (1988) and Rajan and Zingales (1995) for examples of the latter.) While the two interpretations are closely related, they are not one in the same so that differences in our results relative to these earlier studies need not suggest an inconsistency.

In Panel A, we see that larger firms maintain relatively lower cash targets. This result is unsurprising as Table III suggests that internal resources is the primary source of investment funding for larger firms, who also have relatively lower future investment and consequently less need for financial slack. Greater anticipated investment is associated with greater cash targets, as it should be if internal funds are the first rung of the pecking order and financial slack is important. Though we would expect future cash flows to be negatively related to cash targets, since greater cash flows require less cash reserves, we find an insignificant coefficient on this variable in our model.

We also see larger cash targets associated with higher growth opportunities (proxied for by market-to-book and R&D expenditures relative to sales), consistent with firms stockpiling cash to fund future investments. Dividend paying firms have lower cash targets, which is a bit difficult to explain given this cash requirement and the fact that many firms maintain cash reservoirs earmarked for dividends (Kalay (1982)). We do not find a significant relationship between cash targets and expected bankruptcy costs (proxied for by cash flow volatility and z-score). As expected, Net Working Capital is negatively associated with cash targets. Finally, higher leverage is associated with higher cash targets, consistent with firms stockpiling cash in anticipation of greater fixed commitments.

The debt capacity model results are in Panel B of Table IV and, though broadly consistent with the predictions of a modified pecking order, show several puzzling results that are indicative of the model's difficulty in correctly identifying separating debt and decisions. Firm size shows a negative relation with debt capacity. Typically, larger firms are associated with greater debt capacity because they are inherently more diversified

than their smaller counterparts, or, perhaps, because larger firms are assumed to have the resources (liquid and illiquid assets) to maintain greater levels of debt. Greater future investment is associated with larger current debt capacity implying that firms are able to issue more debt today, counter to what one would expect if firms are following a modified pecking order whereby they conserve debt capacity today for future investment. Finally, anticipated cash flows are negatively related with current debt capacity, which is also at odds with the modified pecking order since firms need not worry about conserving debt capacity today with sufficiently high future cash flows.

Cash flow volatility and growth opportunities are inversely related to debt capacity, as they should be if bankruptcy costs and underinvestment (as detailed in Myers (1977)) are concerns. Firm age and Altman’s Z-score are positively related to debt capacity, consistent with arguments in Lemmon and Zender, as is asset tangibility, which has the strongest statistical relation to debt capacity. Greater tangible assets results in a lower expected cost of debt capital since the debt is more likely to be secured.

But for the noted exceptions, the covariates in the debt capacity model exhibit relations that are directionally consistent with the theoretical predictions. We now turn to the predictive ability of the model in order to determine whether the estimated associations result in an accurate description of actual financing decisions.

### *B. Prediction Accuracy*

Because our empirical approach is to model the actual financing decisions of firms, it is natural to ask: how often does the pecking order correctly predict financing choices? As a benchmark for comparison, we use the simulation results discussed above and presented in Table I. Table V presents a summary of the prediction accuracy of the model stratified by firm size, which previous studies (e.g., Roper (2002) and Lemmon and Zender (2003)) have shown to capture life-cycle affects in the financial policies of firms. Though we only present the prediction results obtained from the cash threshold and debt capacity specifications in Table IV, the results are robust to a large number of changes in these specifications.<sup>13</sup> Panel A shows that of the firm-years for which internal funds are used for financing, the model correctly predicts these financing decisions over 86% of the time

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<sup>13</sup>We examine the results after removing forward looking variables, modifying the definition of investment and cash flow (as discussed earlier), removing R&D expenses, including the ratio short-term to long-term debt as a measure of maturity structure (see Barclay and Smith (1995)). In all cases, the results were either materially unaffected or strengthened our conclusions.

for all size quantiles. However, of the firm-years for which external funds are used for financing, the model correctly predicts these financing decisions less than 40% of the time and only 28% of the time for the largest firms. That is, firms, large firms in particular, turn to external capital markets more often than would be expected if the pecking order was the sole factor driving financing decisions since more often than not firms tend to have internal resources sufficient to cover current and anticipated investment. Thus, while the model is able to accurately identify internal financings, it does so at the expense of failing to explain why firms turn to external funds since the majority of external financing decisions (62%) fall in the region where investment is less than the available cash threshold (i.e.  $Inv_{it} < C_{it}^*$ ). This conclusion is even more evident in light of the simulation results in Table I, which suggest an accuracy rate of almost 90% under the null.

Panel B of Table V shows that the model also struggles to explain why firms issue equity. We see that even for small firms, the model predicts a debt issuance almost 70% of the time when, in fact, firms issued equity. This failure is only magnified as one moves up the size strata. Firms are issuing equity much more often than predicted by the pecking order, consistent with the results of the recent paper by Fama and French (2003). These results are further put into perspective when compared with the simulation results from Panel B of Table I. It is also interesting to note that the model struggles particularly so for large firms, which are most likely to have access to low risk debt. We further investigate this possibility below.

These findings help to illuminate the different conclusions of Frank and Goyal (2003) and Fama and French (2003) regarding the type of firms for which the pecking order performs “best”. Since larger firms tend to issue more debt relative to equity than smaller firms, they appear to provide a better fit in the context of the Shyam-Sunder and Myers (1999) regression framework, as noted by Frank and Goyal. However, when these large firms turn to equity markets, it is rarely the case that their investment needs outstrip their internal resources and debt capacity, which is what Fama and French argue. We see both of these effects in our results, in that the model accurately predicts internal (panel A) and debt (panel B) financing for large firms, but fails to predict external and equity financing for these firms.

Table VI compares firm characteristics between those firm-year observations that violate the pecking order’s predicted financing behavior (Violators) and those adhering to the pecking order’s predicted financing behavior (Non-Violators). This comparison lends further insight into why the pecking order fails to accurately predict financing decisions by showing that, among those firm-year observations predicted to use internal funds or issue

debt, Violating observations are very similar to Non-Violating observations, with respect to firm-characteristics. The Table presents sample medians, since the distributions are skewed and means are very sensitive to extreme observations.

Panel A presents summary statistics for three groups of firms. The first group, Internal Non-Violator, consists of firms that financed their investment solely with internal funds, as predicted by the model. The second group, External Violator, consists of firms that turned to the external capital markets (debt or equity), despite the model predicting the use of only internal funds. The final group, External Non-Violator, consists of firms that turned to the external capital markets, as predicted by the model. For most characteristics, Internal Non-Violators and External Violators are quite similar, whereas External Non-Violators show marked differences. For External Non-Violators the market-to-book ratio, anticipated investment, and expected future financing need are significantly larger relative to the other two groups, which show relatively small differences, if any. Similarly, External Non-Violators are much smaller, younger and less financially stable (i.e., lower Z-score) than the other two groups. Of course, these results are to be expected given the analysis presented above. They illustrate that for the majority of external financing decisions, the pecking order cannot distinguish between firms using internal and firms using external funds.

Panel B of Table VI presents a similar analysis for three analogous groups of firms. The first group, Debt Non-Violator, consists of firms that issued debt, as the model predicted. The second group, Equity Violator, consists of firms that issued equity, despite the model's prediction of a debt issuance. The final group, Equity Non-Violator, consists of firms that issued equity, consistent with the prediction of the model. As expected from the prediction results above, the first two groups of firms are very similar in terms of their characteristics, while the third group is significantly different along many dimensions. Equity Non-Violators have more growth-opportunities (i.e., higher market-to-book and R&D expenditures), more current and anticipated investment, and greater cash flow volatility relative to the other two groups. They are also smaller, have fewer tangible assets and are younger.

These results further highlight the shortcoming of the aggregate regression framework used in previous studies. While it is true that firms with greater investment and fewer internal resources are more likely to turn to external finance, the majority of external financings (62%) occur despite firms having sufficient funds to cover their current (and anticipated) investment needs. Similarly, firms are more likely to use equity financing as investment increases and/or cash flow decreases but the majority of equity financings

occur when firms still have sufficient debt capacity to fill their investment needs.

Indeed, for the large majority of equity issuances, the characteristics of the issuing firms suggest that they are anything but constrained in their financing options. Book leverage is similar for the Equity Violators and Debt Non-Violators. Expected cash flows are actually higher for the Equity Violators than the Debt Non-Violators, although anticipated investment and investment needs are higher, as well. Finally, the Equity Violators are only moderately smaller and less financially healthy than the Debt Non-Violators. Thus, at this point, arguing that most equity issuers are facing debt capacity concerns is tenuous, although we look more closely at this issue below.

In sum, we have the following conclusions thus far. Though firms do a majority of their investment financing using internal funds, the pecking order fails to explain why firms turn to external financing when they do. In a majority of observations for which firms use external capital, the internal resources are sufficient to cover both current and anticipated investment. Similarly, the pecking order fails to explain why firms issue equity when they do. The large majority of equity issuances occur when firms have sufficient debt capacity to cover current and anticipated investment, without any apparent risk of entering financial distress from issuing debt.

### *C. Time Varying Information Asymmetry*

Several previous studies have demonstrated, both theoretically and empirically, the impact of time-variation in adverse selection costs on security issuance decisions (see, for example, Korajczyk, Lucas and McDonald (1990, 1991), Choe, Masulis and Nanda (1993), and Bayless and Chaplinsky (1996)). Since the pecking order relies on these costs to create the predicted financing hierarchy, this time variation suggests that we should find stronger evidence of such a hierarchy in times when adverse selection costs are higher. This raises the possibility that the failure of our model to predict the majority of external issuances and equity issuances may be driven by a large number of observations in periods of low asymmetric information costs. In addition, Choe, Masulis and Nanda document that the variation in asymmetric information costs is associated, at least in part, with business cycle movements. Therefore, the market timing motivations that we document below may not be necessarily inconsistent with the pecking order if periods of high equity returns are also periods of low adverse selection costs.

To evaluate this possible explanation for our results, we split the years in our sample period into “hot” (high equity issuance), “cold” (low equity issuance), and neutral years,

following Bayless and Chaplinsky (1996). We then estimate our model separately on the “hot” and “cold” sub-samples. If our previous results are being driven by time-varying asymmetric information costs, we would expect the model to perform significantly better in the “cold” periods (high cost) than in the “hot” periods.

We define hot and cold years in three ways. First, we use the periods defined by Bayless and Chaplinsky, who use monthly data. If at least seven months of a sample year are designated a hot period by Bayless and Chaplinsky (and no months in that year designated cold), we define that year to be hot, and vice versa for cold years. Since their sample only extends through 1990, we define two alternative, but similar in spirit, measures to utilize our entire sample period. We rank each year according to either the number of issuances scaled by the number of sample firms or the total net issuance volume scaled by the total market value of equity in the sample. (This last measure controls for market value fluctuations and most closely matches the measure reported by Bayless and Chaplinsky.) We then define hot years to be those years in the upper quartile and cold years to be those years in the bottom quartile.

The results using the last measure are presented in Table VII.<sup>14</sup> Contrary to the prediction discussed above, the model is not better able to predict external issuances or equity issuances in the “cold” periods. If anything, it does better in predicting these issuances in hot periods, but the model does not perform significantly better in either sub-sample than in the overall sample. Thus, firms often violate the hierarchy even when adverse selection costs are greatest.

#### *D. Are Equity Issuances Due to Debt Capacity Concerns?*

Despite attempting to control for debt capacity within the model, we now look more closely at equity issuers in an attempt to determine whether or not debt capacity concerns are a key factor in equity issuance decisions, as suggested by Lemmon and Zender (2003). We do so by comparing equity issuers to a sample of private borrowers for which we have detailed information on the loan and firm characteristics. Since equity issuers are, on average, significantly smaller and younger firms, their primary source of financing outside of equity markets is private lenders, as opposed to public debt markets which are restricted to larger, more established firms.<sup>15</sup> Thus, we are able to directly address the

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<sup>14</sup>The results using the two alternative definitions described above are very similar to those in Table VII and, as such, are not presented.

<sup>15</sup>See Denis and Mihov (2003) for an analysis of the lender decision.

issue of whether the firms that issued equity in violation of the pecking order’s prediction (Equity Violators), were in fact unable to borrow money.

Our private lender data for this analysis is an August 2002 extract of the Dealscan database, marketed by Loan Pricing Corporation (LPC). The data consists of dollar denominated private loans made by bank (e.g., commercial and investment) and non-bank (e.g., insurance companies and pension funds) lenders to U.S. corporations during the period 1990-2001. According to Carey and Hrycray (1999), the database contains between 50% and 75% of the value of all commercial loans in the U.S. during the early 1990s. From 1995 onward, Dealscan contains the “large majority” of sizable commercial loans. According to LPC, approximately half of the loan data are from SEC filings (13Ds, 14Ds, 13Es, 10Ks, 10Qs, 8Ks, and registration statements). The other half is obtained from contacts within the credit industry and from borrowers and lenders.

Table VIII presents a comparison of the Equity Violators’ firm characteristics with the firm characteristics of our sample of private borrowers. Because our private borrower data is limited to the time period 1990-2001, we restrict our attention to the sample of Equity Violators over the same period. The first four columns present a synopsis of the distribution of each firm characteristic for the sample of private borrowers: the 25th percentile, median, 75th percentile and average. The fifth and sixth columns present the median and average values for the sample of Equity Violators. The last column presents t-statistics testing the difference in means between the two samples.<sup>16</sup>

Both average and median book leverage is significantly lower for the Equity Violators relative to the sample of bank borrowers. Profitability is significantly higher (though economically equivalent) for the Equity Violators. The Equity Violators also have a higher interest coverage ratio (EBITDA / Interest Expense), current ratio (Current Assets / Current Liabilities), and quick ratio ((cash + receivables) / current liabilities), all indicative of a more financially healthy set of firms. Importantly, that current profitability and investment are economically very similar (in terms of means and medians) suggests that Equity Violators are not facing excessive financing deficits that can only be funded by way of issuing equity. We do note, however, that the Equity Violators tend to be smaller, have more investment opportunities and higher revenue volatility relative to the sample of private borrowers. But, we doubt that these traits are prohibitive since the average and median values among the Equity Violators are far from the tails of the

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<sup>16</sup>We perform a two-sided test of the null hypothesis that the population means are equal, assuming the underlying sampling distribution is normal. The standard error is computed after adjusting for clustering at the firm level.

distributions for these variables among the private borrowers. For example, the median market-to-book ratio (1.62) is only slightly higher than the median among the bank borrowers (1.41) and well below the 75th percentile (1.96) suggesting that the majority of Equity Violators fall in the middle of the bank borrower's distribution. Also, there is no statistically significant difference between lagged and current capital expenditures between the two samples. In sum, the Equity Violators do not appear terribly different from firms that actively borrow from the private lending markets.

Though suggestive, one potential concern with the above analysis is that it is unconditional. Our next analysis addresses this issue by estimating a model of loan yields, following the analysis of Bradley and Roberts (2003), in an effort to compute the (expected) promised yields that Equity Violating firms would face if they had turned to the private lending markets. The goal of this analysis is not a precise model of loan pricing but, rather, simply a method to address the conditional nature of the borrowing process. Because of obvious data constraints, we are restricted to including characteristics in our model that are observable for both groups of firms: bank borrowers and Equity Violators. Thus, our model incorporates firm-specific characteristics and macroeconomic factors but does not incorporate information specific to the loan, as this is unobservable for the sample of Equity Violators. This raises the issue of whether the group of equity issuers would enter into loans that are different, in terms of contract structure, than our sample of private borrowers (i.e., are the samples different across unobservable characteristics?). We attempt to mitigate this problem by including both industry and year fixed effects to control for possible selection differences between the two groups based on their industry or timing of investment opportunities. Additionally, we note that the financial deficit facing the Equity Violators is not much different from that facing the private borrowers, as inferred from Table VIII. As such, there is no reason to believe that the size of the loans would be significantly different for the Equity Violators.

Panel A of Table IX presents the coefficient estimates from the estimation of the loan yield equation. We avoid discussing these results, which suppress the fixed effects coefficients, instead noting that they are broadly consistent with those found in Bradley and Roberts (2003). Instead we focus attention on Panel B, which presents a comparison of yield distributions across four groups of firms. The first group (All Borrowers) includes all firms in the sample of the private borrowers described above. The second (Equity Violators) and third (Equity Non-Violators) groups are firms that issued equity in violation of or adherence to, respectively, the pecking order prediction from our empirical model of financing decisions. These groups are the same ones discussed earlier in the

context of Table VI and are restricted to observations during the period 1990-2001, so as to coincide with the private borrower data. The final group (Complete Data Borrowers) is the subsample of the All Borrowers group that has complete data for all of the relevant accounting variables included in the loan yield regression.

We see that the actual yield distribution for the sample of bank borrowers included in the regression (i.e., conditional on nonmissing values for all of the covariates) has a mean (median) promised yield of 147 (113) basis points above LIBOR. The mean (median) predicted yield for our sample of equity violators is 173 (170) basis points. Thus, while the average equity violator is likely to face a higher promised yield on their loan, the important point to note is that the majority of the estimated yield distribution for the Equity Violators lies well below the 75th percentile of the actual yield distribution of the bank borrowers (225 basis points). In fact, the 75th percentile of the Equity Violators estimated loan yield distribution (229) is approximately equal to that of the Complete Data Borrower's. Further, when compared to the entire sample of private borrowers (All Borrowers), the equity issuers show a lower average (median) promised yield. This is in stark contrast to the Equity Non-Violators estimated yield distribution, which is shifted well to the right of the other three groups. Consequently, debt capacity concerns are likely to be important to this group of firms, although they represent a small minority of equity issuers.

One potential concern with this analysis is that our sample of loans might consist of risky securities, which face adverse selection costs similar in magnitude to equity.<sup>17</sup> In this instance, the distinction between debt and equity is less clear according to the pecking order. We look more closely at the riskiness of the loans in our sample by comparing the duration matched credit spreads of the loans to that of investment grade public debt. More specifically, we take each loan and subtract off the yield of a 6-month T-bill.<sup>18</sup> The average spread is 2.0%, compared to an average spread between BAA 30-year bonds and 30-year T-bills of 1.7% for the same 1990-2000 period.<sup>19</sup> This 30 basis point spread is more likely to be a liquidity premium than a difference in default risk, suggesting that our sample of loans have a risk profile similar to that of a BAA bond. While the private loans may be more restrictive in terms of their covenant provisions, these results suggest that our sample of loans are on the low end of the risk spectrum for debt instruments.

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<sup>17</sup>We thank Mike Lemmon for pointing out this possibility.

<sup>18</sup>We do not simply match maturities because most loans are floating rate securities with 6-month interest rate resets.

<sup>19</sup>The interest rate data come from the FRED database.

In sum, equity issuers violating the pecking order's prediction of a debt issuance do not appear to be motivated primarily by debt capacity concerns. Tables VIII and IX show that the large majority of equity issuers are very similar to their debt-issuing counterparts, in terms of firm characteristics, and would likely experience a cost of debt capital that is anything but abnormal. Thus, the pecking order, even with the added flexibility provided by allowing for debt capacity concerns, struggles to predict the large majority of equity issuances, much like its difficulty in explaining why firms turn to external capital markets to begin with.

## V. Concluding Remarks

We develop an empirical model of the pecking order that accounts for the value of financial slack, in an effort to test whether firms' financial policies are true to the financing hierarchy implied by the theory. Our model avoids the statistical power problems associated with previous empirical studies, while also incorporating the insight of Lemmon and Zender (2003) that firms' desires for financial slack may compel them to violate the strict financing hierarchy. We find that the pecking order cannot explain why, at least in a majority of instances, firms use external capital markets and why firms issue equity. That is, firms violate the financing hierarchy more often than not and these violations do not appear to be due to concerns over anticipated investment or future adverse selection costs.

Even when we account for time-varying adverse selection costs and debt capacity concerns beyond that incorporated into the model, the pecking order fails to adequately classify most financing decisions. A comparison of a majority of equity issuing firms with a large sample of firms that enter into private loan agreements reveals that these two samples are similar with respect to firm characteristics, internal resources and investment opportunities. Rather, most equity issuing firms, had they instead chosen to turn to the private debt market, would have likely faced loan terms in line with their debt issuing counterparts. As a result, we find little empirical support for either static or dynamic (i.e., modified) versions of the pecking order.

While our evidence suggests that the pecking order's financing hierarchy is not an accurate description of actual financing behavior, our results are not necessarily inconsistent with information asymmetry playing an important role in determining corporate capital structure. Lukin and Fulghieri (2001) show that the pecking order can be reversed when information production costs are sufficiently low. A recent working paper by Gomes

and Phillips (2004) finds information asymmetry to be an important determinant of the debt/equity decision, but its effect on those decisions depends crucially on which market the transaction takes place: private or public. Thus, a question for future research is precisely how information asymmetry manifests itself in the decision making process.

## Appendix A: Likelihood Derivation

In the data, there are three possible outcomes beginning with the decision to use internal funds (i.e.,  $External_{it} = 0$ ). In this case, we do not observe the decision between debt and equity and thus the likelihood of this outcome is simply:

$$\begin{aligned}
\Pr(External_{it} = 0) &= \Pr(y_{1it}^* \leq 0) \\
&= \Pr(Inv_{it} - CashBal_{it-1} - CashFlow_{it} + X_{1it-1}\beta_1 \\
&\quad + X_{2it-1}\beta_2 + \varepsilon_{it} \leq 0) \\
&= \Phi(-Inv_{it} + CashBal_{it-1} + CashFlow_{it} - X_{1it-1}\beta_1 \\
&\quad - X_{2it-1}\beta_2)
\end{aligned} \tag{14}$$

where  $\Phi(x)$  is the probability that  $\varepsilon \leq x$  and  $\varepsilon$  is distributed  $N(0,1)$ . Note that we have implicitly assumed that  $\sigma_\varepsilon = 1$  for identification purposes.

The second scenario is when the firm chooses to go to the external capital markets and then decides to use debt financing. This outcome occurs with probability:

$$\begin{aligned}
&\Pr(External_{it} = 1 \cap Equity_{it} = 0) \\
&= \Pr(y_{1it}^* > 0 \cap y_{2it}^* \leq 0) \\
&= \Pr(\{\varepsilon_{it} > -Inv_{it} + CashBal_{it-1} + CashFlow_{it} - X_{1it-1}\beta_1 - X_{2it-1}\beta_2\} \\
&\quad \cap \{\omega_{it} \leq -Inv_{it} + CashBal_{it-1} + CashFlow_{it} - X_{1it-1}\beta_1 - X_{2it-1}(\beta_2 - \gamma_1) \\
&\quad + X_{3it-1}\gamma_2 - Debt_{it-1}\}) \\
&= \Pr(\{\varepsilon_{it} \leq Inv_{it} - CashBal_{it-1} - CashFlow_{it} + X_{1it-1}\beta_1 + X_{2it-1}\beta_2\} \\
&\quad \cap \{\omega_{it} \leq -Inv_{it} + CashBal_{it-1} + CashFlow_{it} - X_{1it-1}\beta_1 - X_{2it-1}(\beta_2 - \gamma_1) \\
&\quad + X_{3it-1}\gamma_2 - Debt_{it-1}\}) \\
&= \Phi_2(Inv_{it} - CashBal_{it-1} - CashFlow_{it} + X_{1it-1}\beta_1 + X_{2it-1}\beta_2, \\
&\quad (1/\sigma_\omega)[-Inv_{it} + CashBal_{it-1} + CashFlow_{it} - Debt_{it-1} - X_{1it-1}\beta_1 \\
&\quad - X_{2it-1}(\beta_2 - \gamma_1) + X_{3it-1}\gamma_2], -\rho)
\end{aligned} \tag{15}$$

where  $\Phi_2$  is the bivariate standard normal with correlation coefficient  $\rho$ .

The third and final scenario occurs when firms choose to go to the external capital

market and then decide to use equity financing. This outcome occurs with probability:

$$\begin{aligned}
& \Pr(External = 1 \cap Equity = 1) \\
&= \Pr(y_{1it}^* > 0 \cap y_{2it}^* > 0) \\
&= \Pr(\{\varepsilon_{it} > -Inv_{it} + CashBal_{it-1} + CashFlow_{it} - X_{1it-1}\beta_1 - X_{2it-1}\beta_2\} \\
&\quad \cap \{\omega_{it} > -Inv_{it} + CashBal_{it-1} + CashFlow_{it} - X_{1it-1}\beta_1 - X_{2it-1}(\beta_2 - \gamma_1) \\
&\quad + X_{3it-1}\gamma_2 - Debt_{it-1}\}) \\
&= \Pr(\{\varepsilon_{it} \leq Inv_{it} - CashBal_{it-1} - CashFlow_{it} + X_{1it-1}\beta_1 + X_{2it-1}\beta_2\} \\
&\quad \cap \{\omega_{it} \leq Inv_{it} - CashBal_{it-1} - CashFlow_{it} + X_{1it-1}\beta_1 + X_{2it-1}(\beta_2 - \gamma_1) \\
&\quad - X_{3it-1}\gamma_2 + Debt_{it-1}\}) \\
&= \Phi_2(Inv_{it} - CashBal_{it-1} - CashFlow_{it} + X_{1it-1}\beta_1 + X_{2it-1}\beta_2, \\
&\quad (1/\sigma_\omega)[Inv_{it} - CashBal_{it-1} - CashFlow_{it} + Debt_{it-1} + X_{1it-1}\beta_1 \\
&\quad + X_{2it-1}(\beta_2 - \gamma_1) - X_{3it-1}\gamma_2], \rho) \tag{16}
\end{aligned}$$

Let  $\psi_{1it}$ ,  $\psi_{2it}$ , and  $\psi_{3it}$  denote the three terms in equations (14), (15), and (16), respectively. The log likelihood is thus:

$$\begin{aligned}
\log L_{it} = & \sum_{i=1}^N \sum_{t=1}^{T_i} (1 - External_{it}) \log(\psi_{1it}) + External_{it}(1 - Equity_{it}) \log(\psi_{2it}) \\
& + External_{it}(Equity_{it}) \log(\psi_{3it}) \tag{17}
\end{aligned}$$

The standard errors are adjusted for clustering by employing the generalized estimation equation approach of Liang and Zeger (1986)

## Appendix B: Statistical Power

Our simulation begins by generating a sequence of investments, cash thresholds and debt capacities for 1,000 firms over a 100 year period according to:

$$Inv_{it} = 10 * \eta_{it} \tag{18}$$

$$\delta_{it} = 7 + \epsilon_{1it} \tag{19}$$

$$\alpha_{it} = 2.5 + \epsilon_{2it} \tag{20}$$

where  $\delta_{it}$  is the firm's cash capacity and  $\alpha_{it}$  is the firm's debt capacity,  $\eta_{it}$  is a random variable distributed uniformly on the unit interval and  $\epsilon_j, j = 1, 2$  are independent standard normal random variables. The distributional assumptions and constants are

chosen so that the ratios of internal versus external decisions and debt to equity decisions matches that observed in the data (approximately 7 to 3 for both decisions) and are made without any loss of generality.

We then define the latent decision variables  $y_{1it}^*$  and  $y_{2it}^*$  in a manner consistent with the pecking order. That is, for each observation define:

$$y_{2it}^* = Inv_{it} - \delta_{it} + \varepsilon_{it} \quad (21)$$

$$y_{1it}^* = Inv_{it} - \delta_{it} - \alpha_{it} + \omega_{it} \quad (22)$$

$$(23)$$

where

$$\varepsilon, \omega \sim N \left( \begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 & 0.7 \\ 0.7 & 1 \end{bmatrix} \right)$$

Finally, the generated latent variables are translated into issuance decisions according to the pecking order's decision rule: if  $y_2^* < 0$ , use internal funds; if  $y_2^* > 0$  and  $y_1^* < 0$ , use debt financing; if  $y_2^* > 0$  and  $y_1^* > 0$ , use equity financing. We use this rule since dual issues are rare in the data and, as Stafford (2001) shows, cash balances tend to increase after large investments suggesting that capital raising activities substitute for internal fund usage. Regardless, we also perform the simulation using the rule that firms use multiple sources to finance investment. That is, if  $y_2^* > 0$  and  $y_1^* > 0$  firms use both debt and equity financing, i.e. two financing decisions. The results are largely unaffected and as such we restrict attention to the results obtained from the first scenario.

In tandem, we perform a separate simulation that randomly assigns financing decisions by drawing two random variables,  $y1'$  and  $y2'$  each period from independent uniform(0,1) distributions. The decision rule is then: if  $y2' \leq 0.7$  use internal funds; if  $y2' > 0.7$  and  $y1' \leq 0.7$ , use debt financing; if  $y2' > 0.7$  and  $y1' > 0.7$ , use equity financing. This alternate sequence of financing decisions is then used along with the same investment,  $\delta$  and  $\alpha$  data generated above to re-estimate the model.

In order to estimate the Shyam-Sunder and Myers (1999) model (equation (12)), we require the change in debt, change in equity and total financing deficits implied by each sequence of financing decisions. The pecking order is ambiguous on how to make this translation, as it depends on the nature of adjustment costs and value of future financial slack. Consider the case where a firm's desired investment is \$150 and they have internal funds of \$100 and additional debt capacity of \$100. Under a strict pecking order, ignoring dynamic considerations and transactions costs, we would expect the firm to fund the first

\$100 of investment with internal funds and the next \$50 with new debt. Given a likely desire to minimize transactions costs and preserve future financial slack, it is perhaps more desirable to fund the entire \$150 with new debt.

We therefore calculate  $\Delta D$ ,  $\Delta E$  and  $FinDef$  in two manners. In both methods, if the financing decision is to use internal funds,  $\Delta D = \Delta E = 0$ . In the first approach, if the financing decision is a debt issuance then  $\Delta D$  equals the difference between the simulated investment and cash threshold ( $C^*$ ) and  $\Delta E = 0$ . If the financing decision is an equity issuance then  $\Delta E$  is equal to the difference between investment and the debt threshold ( $D^*$ ) and  $\Delta D$  is equal to the firm's debt capacity ( $D^* - C^*$ ). In the second approach, which allows for the impact of transaction costs and valuable financial slack, if the financing decision is a debt issuance then  $\Delta D$  is set equal to investment and  $\Delta E = 0$ . If the financing decisions is an equity issuance then  $\Delta E$  is set equal to investment and  $\Delta D = 0$ . In both cases,  $FinDef = \Delta D + \Delta E$ , consistent with the accounting identity. Since both cases have little effect on the estimation results, we focus on those obtained using the second decision rule, consistent with that presented in Table 1.

For the issuance decisions generated from the random model, we note that there is no relation between the financing choice and the size of investment relative to available cash and debt capacity. This results in cases where, for example, investment is less than available cash, but the firm issues debt. Therefore, we cannot use the strict pecking order method for calculating  $\Delta D$  and  $\Delta E$  for the random model simulation and rely only on the second approach. When the Shyam-Sunder and Myers regression is estimated using the data generated according to the pecking order, however, we obtain similar results from each approach for calculating  $\Delta D$  and  $\Delta E$ . Therefore, we do not believe that this assumption is a serious limitation.

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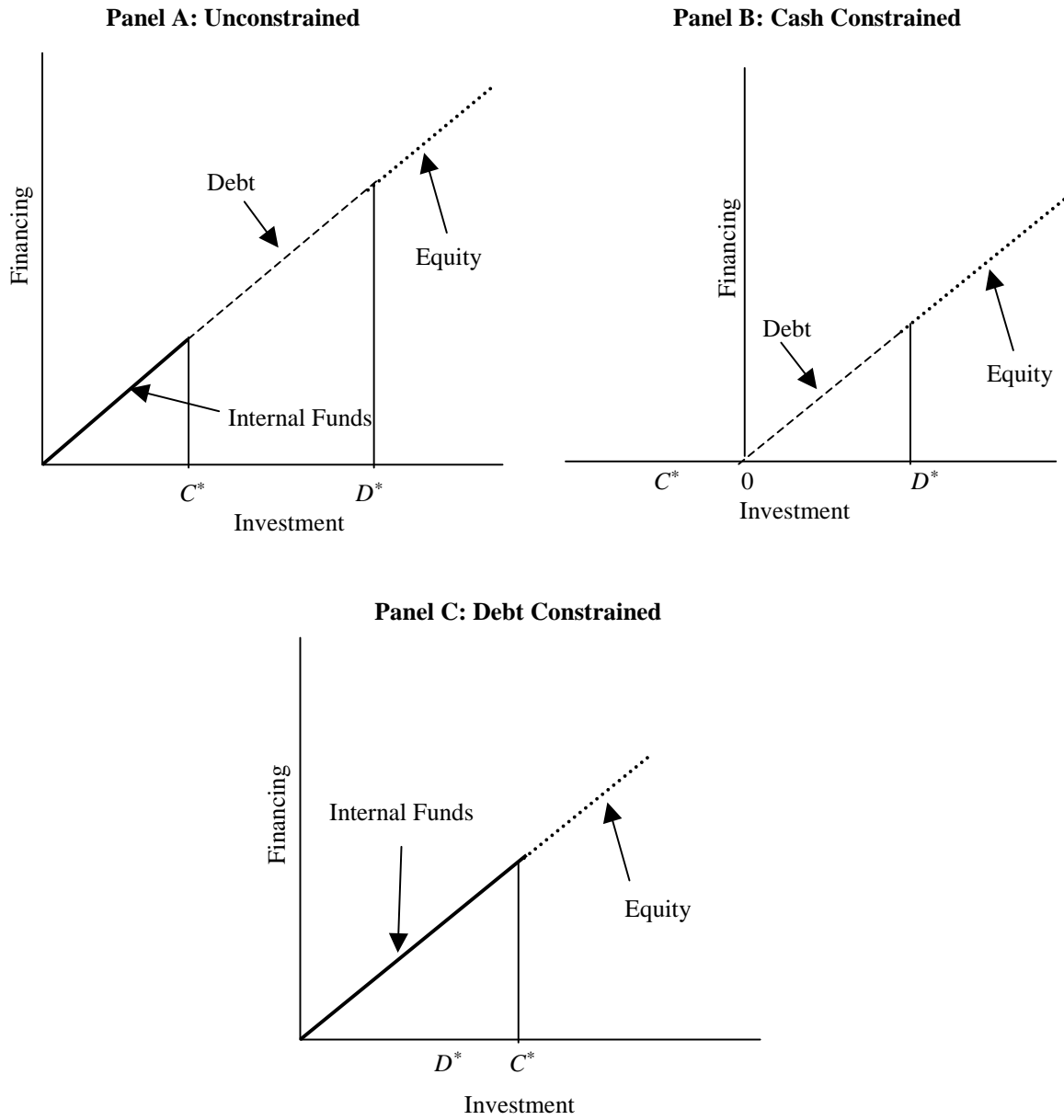
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**Figure 1**  
**Empirical Implications of the Modified Pecking Order**



## Table I Simulation Results

The model and simulation experiment are described in Appendix B. Panel A presents the prediction accuracy of the estimated model for each of two decisions: internal versus external financing and, conditional on using external financing, debt versus equity. Two sets of results are presented corresponding to estimation of the model on two sets of data. The first set of decisions (Pecking Order Data) is generated according to the implied financing hierarchy of the pecking order and the second set (Random Data) is generated randomly. Both sets of decisions are generated in a manner to ensure that 62% of the financing decisions are internal and, conditional on using external financing, 60% of the financing decisions select debt. This approximates the ratios observed in the data (see Table III below). For example, of the Pecking Order simulated internal financing decisions, 93.6% are correctly predicted as internal financings by the model. Similarly, of the Random simulated equity financings, 43.7% are correctly predicted by the model. Panel B presents coefficient estimates of the Shyam-Sunder and Myers (1999) regression, using both the Pecking Order and Random simulated data. The regression is:

$$\Delta Debt_t = \alpha + \beta \text{Financial Deficit}_t + \varepsilon_t,$$

where

$$\text{Financial Deficit}_{it} = \text{Dividends}_{it} + \text{Investment}_{it} + \Delta \text{WorkingCapital}_{it} - \text{CashFlow}_{it}.$$

Panel A: Prediction Accuracy

Simulated Decision	Predicted Decision (Pecking Order Data)		Predicted Decision (Random Data)	
	Internal	External	Internal	External
Internal	93.6%	6.4%	57.3%	42.7%
External	10.6%	89.4%	57.0%	43.0%
	Debt	Equity	Debt	Equity
Debt	89.0%	11.0%	55.5%	44.5%
Equity	23.4%	76.6%	56.3%	43.7%

Panel B: Shyam-Sunder and Myers Regression Coefficient Estimates

Variable	Coefficient Estimates	
	Pecking Order Data	Random Data
Constant	0.16	-0.00
Financial Deficit	0.51	0.60
$R^2$	0.40	0.52

**Table II**  
**Distribution of the Magnitude of Debt and Equity Issuances**

The sample comes from the annual Compustat files during the period 1971-2001. Debt issuance size is computed using the change in total debt (long term plus short term) from year  $t - 1$  to  $t$  relative to total assets in year  $t - 1$ . The equity issuance size is defined for year  $t$  as the product of (1) the split-adjusted growth in shares and (2) the average of the split adjusted stock price at the beginning and end of the fiscal year, where both terms are obtained from Compustat data. The table presents the density and distribution of each type of issuance.

Issuance Size	Cumulative		Cumulative	
	Debt	Debt	Equity	Equity
[0, 0.01)	12.7%	12.7%	51.1%	51.1%
[0.01, 0.02)	9.8%	22.4%	12.5%	63.6%
[0.02, 0.03)	8.0%	30.5%	6.2%	69.8%
[0.03, 0.04)	7.3%	37.7%	4.0%	73.8%
[0.04, 0.05)	6.1%	43.8%	2.8%	76.6%
[0.05, 0.07)	10.8%	54.6%	3.7%	80.4%
[0.07, 0.10)	11.7%	66.3%	3.8%	84.1%
[.10, $\infty$ )	33.7%	100.0%	15.9%	100.0%

**Table III**  
**Financing Decisions and Firm Characteristics**

The sample comes from the annual Compustat files during the period 1971-2001. Debt issuances are defined as a change in total debt (long term plus short term) from year  $t - 1$  to  $t$  divided by total assets in year  $t - 1$  in excess of 5%. Equity issuances are defined for year  $t$  as the product of (1) the split-adjusted growth in shares and (2) the average of the split adjusted stock price at the beginning and end of the fiscal year, where both terms are obtained from Compustat data, in excess of 5% of total assets at the end of the previous fiscal year. All variables, except for size and age, are scaled by book assets. *Current Inv.* is defined as the sum of capital expenditures, increase in investments, acquisitions, and other use of funds, less sale of PPE and sale of investment; *Liquid Assets* is defined as the sum of cash and marketable securities, inventories, and accounts receivable; *Current Cash Flow* for year  $t$  is defined as the average cash flow growth rate over years  $t-3$  to  $t-1$ , applied to the actual year  $t-1$  cash flow; *Market-to-Book* is defined as the ratio of total assets minus book equity plus market equity to total assets; *Book Leverage* is defined as total debt (short term plus long term) divided by the book value of assets; *Firm Size* is the natural logarithm of book assets; *Anticipated Investment* and *Anticipated Cash Flow* for year  $t$  are the sum of the realized values for years  $t+1$  and  $t+2$  of Investment and Cash Flow (defined as cash flow after interest and taxes net of dividends), respectively; *Tangible Assets* is defined as net property, plant and equipment; *Cash Flow Volatility* is defined as the standard deviation of earnings before interest and taxes, and is based on (up to) the previous 10 years of data for a given firm-year observation; *Firm Age* is defined as the number of years since a given firm first appeared on Compustat.

Financing Decision	% of Obs.	Current Inv.	Liquid Assets	Current Cash Flow	Market-to-Book	Book Leverage	Firm Size	Anticipated Inv	Anticipated Cash Flow	Tangible Assets	Cash Flow Volatility	Firm Age
Internal	62.3%	0.06	0.56	0.10	1.09	0.22	5.34	0.17	0.21	0.30	0.06	18.0
Debt	22.5%	0.14	0.55	0.12	1.17	0.23	5.32	0.20	0.23	0.30	0.05	16.0
Equity	9.7%	0.10	0.59	0.12	1.62	0.22	4.70	0.30	0.29	0.24	0.08	12.0
Dual	5.5%	0.22	0.53	0.13	1.60	0.23	4.95	0.37	0.33	0.29	0.07	12.0

**Table IV**  
**Cash Target and Maximum Debt Determinant Coefficients**

The sample comes from the annual Compustat files during the period 1971-2001. The table presents coefficient estimates and t-statistics (t-stat) adjusted for clustering at the firm level of the partially observed bivariate probit:

$$External_{it} = \begin{cases} 1 & Inv_{it} > C_{it}^* \\ 0 & \text{otherwise} \end{cases}$$

$$Equity_{it} = \begin{cases} 1 & Inv_{it} > C_{it}^* + DC_{it}^* \\ 0 & C_{it}^* < Inv_{it} \leq C_{it}^* + DC_{it}^* \end{cases}$$

where  $External_{it} = 1(0)$  identifies an external (internal) financing decision,  $Equity_{it} = 1(0)$  identifies an equity (debt) issuance,  $Inv_{it}$  is investment, and  $C_{it}^*$  and  $DC_{it}^*$  are functions of observable covariates and parameters  $\beta$  and  $\gamma$ , respectively. Subscripts  $i$  and  $t$  correspond to firms and years. *Dividend Payer* is a dummy variable equal to 1 if a firm paid a positive dividend in year  $t$ ; *Z-score* is defined as the sum of 3.3 times earnings before interest and taxes plus sales plus 1.4 times retained earnings plus 1.2 times working capital divided by book assets; *R & D* is research and development expense as a percent of sales; *RDD* is a binary variable equal to zero if *R & D* is positive and one otherwise. *Net Working Capital* is defined as Other Current Assets minus Total Current Liabilities. The remaining variable definitions are as defined above in Table 3.

Variable	Cash Threshold ( $C_{it}^*$ )		Debt Capacity ( $DC_{it}^*$ )	
	Determinants		Determinants	
	Estimated		Estimated	
	Coefficients ( $\beta$ )	t-stat	Coefficients ( $\gamma$ )	t-stat
Constant	-0.439	-2.49	1.136	5.64
Firm Size	-0.051	-7.79	-0.031	-3.59
Anticipated Investment	0.447	10.72	0.300	6.55
Anticipated Cash Flow	0.022	0.42	-0.375	-7.30
Cash Flow Volatility	-0.106	-0.58	-0.900	-4.20
Dividend Payer	-0.112	-4.49	0.044	1.54
Z-score	-0.006	-0.50	0.002	0.16
R&D / Sales	0.422	2.26	-0.787	-3.16
RDD	0.053	1.93	0.133	3.84
Market-to-Book	0.280	17.19	-0.012	-0.68
Net Working Capital	-1.398	-12.38		
Book Leverage	0.279	4.07		
Tangible Assets			0.828	9.89
Firm Age			0.006	4.43

**Table V**  
**Model Prediction Accuracy**

The sample comes from the annual Compustat files during the period 1971-2001. Panels A and B present the prediction accuracy of the estimated bivariate probit model discussed in the text for each of two decisions: internal versus external financing and, conditional on using external financing, debt versus equity, respectively. Results are presented for the full sample (All) and stratified by firm size quantiles. For example, of the actual internal financing decisions made by small firms in our sample, the model correctly predicted 79.4% of them. Similarly, of the actual equity financing decisions made by large firms, 9.5% are correctly predicted by the model which predicts that the other 90.5% of the observed equity financings should have been debt issuances.

Panel A: Percent of Internal and External Decisions Correctly Predicted

Actual Decision	Size Quintile	Predicted Decision	
		Internal	External
Internal	Small	79.4%	20.6%
	Medium	87.5%	12.5%
	Large	91.5%	8.5%
	All	86.3%	13.7%
External	Small	52.1%	47.9%
	Medium	63.3%	36.7%
	Large	71.9%	28.1%
	All	61.9%	38.1%

Panel B: Percent of Debt and Equity Decisions Correctly Predicted

Actual Decision	Size Quintile	Predicted Decision	
		Debt	Equity
Debt	Small	93.5%	6.5%
	Medium	96.6%	3.4%
	Large	97.1%	2.9%
	All	95.9%	4.1%
Equity	Small	69.7%	30.3%
	Medium	84.0%	16.0%
	Large	90.5%	9.5%
	All	80.2%	19.8%

**Table VI**  
**Firm Characteristics of Issuing Firms**

The table presents a comparison of firm characteristic medians for different subsamples of the Annual Compustat database based on whether or not the empirical model accurately predicted the observed financing decision. Panel A presents summary statistics for: Internal Non-Violators (firm-years for which the observed and predicted decision is to use internal funds), External Violators, (firm-years for which the observed decision is an external financing, debt or equity, and the predicted decision is to use internal funds), and External Non-Violators (firm-years for which the observed and predicted decision is to use external funds). Panel B presents summary statistics for: Debt Non-Violators (firm-years for which the observed and predicted decision is to use debt financing), Equity Violators, (firm-years for which the observed decision is an equity financing and the predicted decision is to use debt financing), and Equity Non-Violators (firm-years for which the observed and predicted decision is to use equity financing). *Future Financing Need* is *Anticipated Investment* minus *Anticipated Cash Flow*. The variable definitions are as defined above in Tables III and IV.

Panel A: Internal Vs. External Decisions

Variable	Internal Non-Violator	External Violator	External Non-Violator
Current Inv.	0.06	0.11	0.22
Liquid Assets	0.57	0.59	0.49
Current Cash Flow	0.10	0.11	0.13
Market-to-Book	1.06	1.14	1.81
Book Leverage	0.22	0.23	0.23
Firm Size	5.47	5.36	4.68
Anticipated Investment	0.16	0.18	0.46
Anticipated Cash Flow	0.21	0.21	0.36
Future Financing Need	-0.04	-0.02	0.13
Tangible Assets	0.29	0.27	0.32
Cash Flow Volatility	0.06	0.05	0.07
Firm Age	19.00	17.00	11.00
Z-score	2.72	2.68	2.12
R&D / Sales	0.005	0.005	0.000
Observations	14,952	6,475	4,006

Panel B: Debt Vs. Equity Decisions

Variable	Debt	Equity	Equity
	Non-Violator	Violator	Non-Violator
Current Inv.	0.14	0.12	0.21
Liquid Assets	0.55	0.57	0.55
Current Cash Flow	0.11	0.13	0.06
Market-to-Book	1.16	1.47	2.89
Book Leverage	0.23	0.23	0.21
Firm Size	5.34	5.02	3.70
Anticipated Investment	0.20	0.30	0.50
Anticipated Cash Flow	0.23	0.30	0.39
Future Financing Need	-0.01	0.03	0.23
Tangible Assets	0.30	0.26	0.21
Cash Flow Volatility	0.05	0.07	0.13
Firm Age	16.00	13.00	9.00
Z-score	2.68	2.38	1.34
R&D / Sales	0.001	0.008	0.035
Observations	5,977	3,394	837

**Table VII**  
**Model Prediction Accuracy During Hot and Cold Years**

The sample comes from the annual Compustat files during the period 1971-2001. Panels A and B present the prediction accuracy of the estimated bivariate probit model discussed in the text for each of two decisions: internal versus external financing and, conditional on using external financing, debt versus equity, respectively. The model is estimated separately for “hot” and “cold” periods, where hot and cold are defined similar to the definition in Bayless and Chaplinsky (1996), which enables us to use our entire sample. That is, we rank each year according to the total net issuance volume scaled by the total market value of equity in the sample. We then define hot years to be those in the upper quartile, based on one of these rankings, and cold years to be those in the bottom quartile. Results are presented for the full sample (All) and stratified by firm size quantiles. For example, of the actual internal financing decisions made by small firms during cold years, the model correctly predicted 87.7% of them. Similarly, of the actual equity financing decisions made by large firms in hot years, 7.3% are correctly predicted by the model which predicts that the other 92.7% of the observed financing decisions during that those years should have been debt issuances.

Panel A: Percent of Internal and External Decisions Correctly Predicted

Actual Decision	Size Quintile	Predicted Decision (Cold Years)		Predicted Decision (Hot Years)	
		Internal	External	Internal	External
Internal	Small	87.7%	12.3%	82.2%	17.8%
	Medium	94.5%	5.5%	88.7%	11.3%
	Large	95.7%	4.3%	92.6%	7.4%
	All	92.7%	7.3%	88.0%	12.0%
External	Small	69.3%	30.7%	50.8%	49.2%
	Medium	83.5%	16.5%	61.1%	38.9%
	Large	85.7%	14.3%	65.7%	34.3%
	All	79.2%	20.8%	58.7%	41.3%

Panel B: Percent of Debt and Equity Decisions Correctly Predicted

Actual Decision	Size Quintile	Predicted Decision (Cold Years)		Predicted Decision (Hot Years)	
		Debt	Equity	Debt	Equity
Debt	Small	95.5%	4.5%	93.8%	6.2%
	Medium	98.9%	1.1%	97.2%	2.8%
	Large	100.0%	0.0%	98.2%	1.8%
	All	98.3%	1.7%	96.6%	3.4%
Equity	Small	84.2%	15.8%	68.8%	31.2%
	Medium	91.8%	8.2%	86.3%	13.7%
	Large	96.5%	3.5%	92.7%	7.3%
	All	90.1%	9.9%	81.4%	18.6%

**Table VIII**  
**Comparison of Equity Issuers and Private Borrowers**

The table presents a comparison of firm characteristics for two samples of firms: (1) borrowers in the private debt market and (2) Equity Violators identified by the bivariate probit model discussed in the text. Private lender data come from an August, 2002 extract of the Dealscan database, marketed by Loan Pricing Corporation (LPC), which consists of dollar denominated private loans made by bank (e.g., commercial and investment) and non-bank (e.g., insurance companies and pension funds) lenders to U.S. corporations during the period 1990-2001. Equity Violators are firm-year observations (restricted to 1990-2001) for which the observed decision is an equity financing and the model-predicted decision is to use debt financing. *Profitability* is the ratio of EBITDA to total assets. *Interest Coverage Ratio* is the ratio of EBITDA to Interest Expense. *Current Ratio* is the ratio of current assets to current liabilities. *Quick Ratio* is the sum of cash and receivables divided by current liabilities. Other variables are as defined in previous tables. The t-stat tests the null hypothesis that the sample means are equal and uses standard errors adjusted for clustering at the firm level.

Panel A: Firm Characteristics

Variable	Private Debt Firms				Equity Violators		Difference in Means	
	25 <sup>th</sup> -Percentile	Median	75 <sup>th</sup> -Percentile	Mean	Median	Mean	t-stat	
Book Leverage	0.16	0.31	0.45	0.32	0.21	0.22	15.09	
Market Leverage	0.11	0.27	0.49	0.32	0.14	0.20	16.49	
Profitability	0.09	0.14	0.18	0.15	0.15	0.15	-2.12	
Maturity Structure	0.66	0.88	0.97	0.76	0.81	0.69	7.00	
Market-to-Book	1.10	1.41	1.96	1.77	1.62	1.88	-3.78	
Cap Exp(t)	0.03	0.05	0.09	0.08	0.06	0.08	-0.43	
Cap Exp(t-1)	0.03	0.05	0.09	0.08	0.05	0.08	0.43	
Market Cap.	0.73	2.81	11.87	25.93	1.19	8.76	6.38	
Firm Size	88.25	328.94	1317.21	2157.63	86.69	643.30	8.75	
Cash Flow Volatility	0.03	0.04	0.07	0.06	0.07	0.09	-7.40	
Z-Score	1.57	2.76	4.31	3.71	3.67	5.35	-9.33	
Current Ratio	1.12	1.61	2.33	2.03	2.14	2.72	-8.72	
Quick Ratio	0.58	0.91	1.41	1.28	1.24	1.81	-7.11	
Interest Coverage Ratio	2.30	4.64	9.80	33.59	6.20	39.54	-0.59	

**Table IX****Actual and Estimated Promised Yields for Borrowers and Equity Issuers**

Private lender data come from an August, 2002 extract of the Dealscan database, marketed by Loan Pricing Corporation (LPC), which consists of dollar denominated private loans made by bank (e.g., commercial and investment) and non-bank (e.g., insurance companies and pension funds) lenders to U.S. corporations during the period 1990-2001. Corresponding firm characteristics come from the annual Compustat database during the period 1990-2001. Panel A presents the estimated coefficients of a linear regression of the promised yield of a loan (measured in basis points above the 6-month LIBOR) on various covariates, which are defined in the previous tables. Test statistics (t-stat) are adjusted for clustering at the firm level. Panel B presents descriptive statistics of the loan yield distribution for four subsamples of firms. All Borrowers corresponds to all firms in the loan database. Equity Violators are firm-year observations for which the observed decision is an equity financing and the predicted decision (from the bivariate probit model discussed in the text) is to use debt financing. Equity Non-Violators are firm-year observations for which the observed and predicted decision is to use equity financing. We obtain the loan yield distribution for these two sets of observations by computing the predicted yield based on the regression results in Panel A. The last group (Complete Data Borrowers) corresponds to the subsample of loans on which the model is estimated.

Panel A: Estimates of Loan Yield Determinants

Variable	Estimate	t-stat
Intercept	512.16	8.76
Book Leverage	139.90	9.68
Firm Size	-33.09	-26.79
Tangible Assets	-2.99	-0.25
Profitability	-272.82	-7.32
Market-to-Book	12.44	5.07
Maturity Structure	-15.11	-1.67
Term Spread	2.71	0.86
Credit Spread	-6.92	-0.36
Regulated	-46.31	-3.20
Cash Flow Volatility	152.51	3.08
Z-Score	-0.28	-0.64
Liquid Assets	96.45	3.72
Investment	-37.58	-1.27
$R^2$	0.56	

Panel B: Loan Yield Distributions

Sample	Obs	25 <sup>th</sup> -Percentile	Median	75 <sup>th</sup> -Percentile	Mean
All Borrowers	10,161	110.00	200.00	300.00	211.58
Equity Violator	1,016	112.84	169.98	229.22	172.96
Equity Non-Violator	158	154.65	224.39	286.76	224.44
Complete Data Borrowers	3,705	45.00	112.50	225.00	146.64