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Costs of Capital and Public Issuance Choice

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The choices of firms raising external capital conform to standard static choice theory in that the higher the (relative) cost of an alternative–both at the overall market level and at the firm level–the less attractive is that alternative. Price elasticities of demand are smaller for more profitable and tangible firms, and larger for larger and more liquid firms. Firm fixed effects account for one-third of the explained choice variation of multiple issuers. Short-term debt is more attractive when the yield curve is steeply sloped, but there is no effect of the market price-earnings multiple on the indirect utility of equity.

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Capital issuance affords a glimpse into the decision-making process of firms. While important in its own right, much of the empirical analysis of the issuance decision is viewed through the prism of capital structure. In particular, it is widely assumed that an issue has a direct effect on the firm's capital and/or debt structure, and that the issuance choice entails a tradeoff between moving toward an optimal (target) capital/debt structure and exploiting current (exogenous) market conditions.[1] However, there is growing theoretical concern and empirical evidence that this capital structure perspective may detract from our ability to learn about corporate decision-making from issuance data. On the theoretical side, for a tradeoff between capital/debt structure and market conditions to exist, there must be a capital markets channel that is inconsistent with traditional notions of market efficiency.[2] In an efficient capital market prices reflect the nature of firms' investment opportunities as well as their capital and debt structures.

On the empirical side the notion of target capital structure is inherently a dynamic one. As such, studies that condition on issuance and explore the role that capital structure plays in the issuance decision suffer from a selection bias. Jung, Kim, and Stulz (1996) anticipate this problem and DeAngelo, DeAngelo and Stulz (2010) formalize it. Furthermore issuance does not have a direct effect on capital structure. Hovakimian (2004, p.1044) finds that public capital issuance does not "offset the deviation from target leverage accumulated prior to the transaction," and Hovakimian (2006) notes that the impact of equity issuance on leverage is economically small. Additionally, Fama and French (2005) show that capital issuance is only one tool for external financing. Welch (2010, p.9) is explicit on this point: "It is a common fallacy to consider evidence of equity issuing to be indicative of (the inverse of) leverage changes."

Combining both empirical and theoretical concerns, Welch (2010) questions the relevance of capital structure theories for understanding issuance. He shows that the notion of target

[1] Marsh (1982, p. 142) finds "that companies are heavily influenced by market conditions and the past history of security prices in choosing between equity and debt. Indeed, these factors appeared to be far more significant in [his] model than, for example, other variables such as the company's existing financial structure." Earlier studies looked at macroeconomic-level data. For example, Bosworth, Smith, and Brill (1971) fit three individual demand equations for equity, long-term debt, and short-term debt. White (1974) considers the cyclicality of debt-term issues. He finds that short-term issues are highly cyclical, whereas long-term debt issues are flatter over the business cycle. Taggart (1977) suggests that there may be a tension between timing and target capital structure (at the aggregate level). Earlier still, Baxter and Cragg (1970) consider 230 issues in the period 1950 - 1965. They assume that issuance and capital structure move *pari pasu* and investigate the hypothesis that issuance is driven by a desire to move capital structure to a target. Taub (1975) links the firm's current capital structure to issuance.

[2] Transactions costs may also cause an issuer to deviate from a target capital structure, as in Leary and Roberts (2005).

leverage is suspect as a reduced-form construct. On a technical level there are questions about what is the appropriate measure of leverage (D'Mello and Farhat 2008). Chen and Zhao (2007) note that since it is a ratio, leverage will tend to mean-revert mechanistically.

In this paper we take a different tack to study issuance choice. In particular, we assume that firms raise external capital as the result of an exogenous shock.[3] Furthermore survey evidence suggests that in choosing the form of new capital, firms are cost-sensitive.[4] We assume that short-term debt, long-term debt, and equity each entail benefits and costs to an issuing firm. We measure the exogenous costs directly from prevailing market prices–at both the individual firm, and aggregate market levels. Cash-flow yield (the ratio of the firm's earnings before interest, taxes, depreciation, and amortization– EBITDA– to the stock price) and the after-tax yields on short- and long-term bonds are our firm-level costs. The earnings-price ratio on the S&P 500 and the yields on short- and long-term Treasury securities are the market level costs of equity, short- and long-term debt, respectively. We cannot measure the benefits from the alternatives directly, but assume that they are correlated with firm attributes, and may also depend on unmeasured firm-level variables (i.e., fixed effects). In this setting capital and debt structures may affect the issuance choice through their effects on capital market costs; and these effects may vary over time and across firms.

We estimate issuers' indirect utility functions using a hierarchical multinomial probit model. Our most important result is that the higher the cost of an alternative, at both the firm and market-wide levels, the lower is the indirect utility of that alternative. Price elasticities of demand vary across issuers as a function of their attributes. For example Figure 1 shows the joint effects of a firm's own cost of equity (Firm E/P) and profitability (left-hand panel); and own cost of equity and size (right-hand panel) on its probability of equity issuance. The figure shows that highly profitable firms' and small firms' choices of debt versus equity are virtually

[3]This assumption rules out the possibility that corporations choose the optimal timing of capital issues, but importantly it establishes that capital market prices at the time of issuance are exogenous with respect to the issuance decision. While heroic this assumption imposes discipline on our specification. Furthermore, DeAngelo, DeAngelo, and Stulz (2010), identify two important features of equity issuance that suggest that this assumption may not be a bad approximation to reality. First, over 80% of those public firms who issue equity are cash-starved. Secondly, most firms that experience run-ups in their stock price do not issue equity. They conclude that "a desire to time the market cannot be the primary motive for selling stock" (p.294). Leary and Roberts (2005) find "that firms are less likely to utilize external capital markets when they have sufficient internal funds, but are more likely when they have large investment needs," (p.2614). They infer from this that issuance entails significant adverse selection costs (à la the pecking order hypothesis)– a result that may be observationally equivalent to issuance occuring as the result of an exogenous shock.

[4]Graham and Harvey (2001) find that chief financial officers of U.S. manufacturing firms say that equity issuance depends on over/under-valuation by the market. The managers also report that they "borrow short-term when they feel that short rates are low relative to long rates or when they expect long-term rates to decline."

independent of their cash-flow yields, whereas medium-sized and less profitable firms' choices exhibit the most cash-flow yield sensitivity.

By examining the choices of the multiple issuers in our sample, we also find evidence of significant firm fixed effects. This result complements Lemmon, Roberts and Zender (2008), who show that cross-sectional differences in capital structure persist over 20 years and are present after controlling for the traditional determinants of capital structure.[5] Issuance choice–a single observable decision–should provide complementary evidence on the importance of firm fixed effects, since capital structure is a temporal average over many decisions and random events. As an example of the importance of firm fixed effects on issuance behavior, consider the 1997 long-term debt issue by McDonalds Corp. If all we learn about this specific choice were to come from the cross-section of issuers (i.e., if we exclude the information contained in McDonalds' other 16 issuances), we estimate the 10%ile posterior probability of this issue being in fact long-term debt to be 17.2%, and the 90%ile posterior probability of this issue being equity to be 59.8%. By including the other 16 choices in our conditioning set, these two posterior probabilities are estimated much more accurately, as 60.2% and 2.1%, respectively.

Firm attributes and market costs contain a lot of redundant information pertaining to the issuance choice. We use variance decompositions to tease out the incremental explanatory power of these two types of variables. On average, we find that the market costs-of-capital account for up to 16% of the explained variation in the debt versus equity choice and 41% in the debt term choice–incrementally to firm attributes and fixed effects. To isolate a possible capital markets channel, we examine the incremental explanatory power of market-wide costs-of-capital. To date, most of the (non-survey) evidence on the existence of a capital markets channel is circumstantial. Lemmon and Roberts (2010) show that the collapse of Drexel Burnham, Lambert (an exogenous capital supply shock) led to a period of quiescence in junk bond financing. Jenter (2005) shows that while managers' insider trading patterns and capital market financing activities are positively correlated, these trades are not profitable. There are a variety of reasons that a capital markets channel might affect observed choices, including regulations (Bernanke and Lown 1991), behavioral biases (Baker and Wurgler 2000, 2002; Baker, Ruback and Wurgler 2007 and Baker, Greenwood, and Wurgler 2003), asymmetric information (Stiglitz and Weiss 1981 and Loughran and Ritter 1995), and private control

[5]Lemmon, Roberts and Zender's (2008) r^2 values in regressions of capital structure on firm fixed effects (around 60%) are three times larger than the r^2 values in regressions of capital structure on the usual time-varying financial variables (around 20%).

benefits (Grossman and Hart 1980). Behavioral biases include the possibility that market prices deviate from underlying fundamentals (also a possibility with asymmetric information), as well as the possibility that the effect of the choice on firm value is minimal and the choice is not subject to market discipline. As an example, Bower (1974, p. 614) states "I have no trouble accepting th[e] hypothesis [that financial managers do speculate on interest rate movements in choosing between long- and short-term debt financing]–most financial managers seem to claim rate speculation as a normal activity." Our results are consistent with Bower's hypothesis–on average up to 28% of the explained variation in the debt term choice is attributable to aggregate market conditions. The scope for such an effect on the choice between debt and equity is much smaller. On average up to 3% of the total variation in the explained variation in the debt versus equity choice is attributable to aggregate market conditions (and we cannot reject the hypothesis that this is 0%).

The remainder of the paper is organized as follows. Section 1 contains a brief review the econometric modeling of choice, the model's data generating process, and our estimation method. We place technical details of the hierarchical multinomial probit model and the Gibbs sampler in three appendices. The data are described in Section 2. We present our results in Section 3. Section 4 concludes the paper.

1. The Choice Model

The multinomial probit model has become the standard approach to discrete choice problems, (Thurstone 1927; Manski and McFadden 1981). Nevertheless, this model poses non-trivial estimation problems, and is the subject of an active research program (for a discussion of the attraction of a Bayesian specification see Geweke 1997). The underlying economic model treats the indirect utilities associated with each alternative as the (endogenous) dependent variables. While these utilities are not observed, we assume that they are correlated with firm attributes. We model these three utilities as a multivariate normal random vector, with a mean that depends on a choice-specific intercept, as well as covariates that characterize each alternative. The covariates on the right-hand-side of the utility equation must be weakly exogenous, choice-specific variables that directly enter the indirect utility function.

We use a hierarchical framework as in Rossi, McCulloch and Allenby (1996). Here, the firm attributes do not enter the indirect utility function directly. Instead the coefficients in the simultaneous equation system linking indirect utilities to the choice characteristics are modeled as linear functions of these attributes. To imbue the model with structural content, the following characterizes the data generating process. For firm i ($i = 1, \ldots, 3,159$) at choice p_i ($p_i = 1, \ldots, P_i$), (suppressing the firm subscript on the choice indicator, p, since it is obvious that we are looking at firm i).

$$\mathbf{U}_{i,p} \equiv \begin{bmatrix} U_{i,p,s} \\ U_{i,p,l} \\ U_{i,p,e} \end{bmatrix}_{3\times 1} = \mathbf{X}_{i,p}\,\boldsymbol{\beta}_i + \boldsymbol{\epsilon}_{i,p} \equiv \left[\mathbf{I}_3 \mid \mathbf{X}^f_{i,p} \mid \mathbf{X}^m_{i,p}\right]_{3\times 5} \times \begin{bmatrix} \beta_{i,1} \\ \vdots \\ \beta_{i,5} \end{bmatrix}_{5\times 1} + \boldsymbol{\epsilon}_{i,p} \qquad (1)$$

$$\boldsymbol{\epsilon}_{i,p} \sim N(\mathbf{0}, \boldsymbol{\Lambda})$$

where:

$$\boldsymbol{\beta}_i \equiv \begin{bmatrix} \beta_{i,1} \\ \vdots \\ \beta_{i,5} \end{bmatrix}_{5\times 1} = \boldsymbol{\Delta}\,\mathbf{Z}_i + \boldsymbol{\eta}_i \equiv [\boldsymbol{\Delta}]_{5\times 9} \times \begin{bmatrix} Z_{i,1} \\ \vdots \\ Z_{i,9} \end{bmatrix}_{9\times 1} + \boldsymbol{\eta}_i \qquad (2)$$

$$\boldsymbol{\eta}_i \sim N(\mathbf{0}, \mathbf{V}_\beta)$$

Here, $U_{i,p,\cdot}$ is the indirect utility provided by each of the three alternatives for firm i at choice p_i: short-term debt (s), long-term debt (l), and equity (e). The weakly exogenous choice characteristics on the right hand side of this system comprise a (3×5) matrix $X_{i,p}$. The first (3×3) submatrix of $\mathbf{X_{i,p}}$ is the identity matrix ($\mathbf{I}_3$) each alternative has a unique intercept. The remaining 2 columns of $\mathbf{X_{i,p}}$ contain the alternatives' characteristics: firm-specific costs ($X^f_{i,p}$) and the market-wide conditions ($X^m_{i,p}$). So the equation for the indirect utility for each alternative has its own intercept, but we impose cross-equation constraints that the coefficients on the costs associated with each alternative are the same in each of the three equations.

In (2), $\mathbf{Z}_i$ is the 9-dimensional vector of exogenous (and fixed) firm attributes for firm i. The first element of $\mathbf{Z}_i$ is a 1 and the remaining eight attributes are described in Section 2.2 below. The intercepts and cost coefficients of each firm's indirect utility functions are stochastic and modeled as functions of the firm attributes. The population is defined by $\boldsymbol{\Delta}$, $\mathbf{V}_{\boldsymbol{\beta}}$, and $\boldsymbol{\Lambda}$. The conditional variance-covariance matrix of the random utility vector is the same for all firms, as is the conditional variance-covariance matrix of $\boldsymbol{\beta}$. All of the modeled heterogeneity in utilities comes from cross-sectional variation in the firm attributes ($\mathbf{Z}$), and variation in the choice characteristics ($\mathbf{X}$). Unmodeled heterogeneity is captured in $\mathbf{V}_{\boldsymbol{\beta}}$, and $\boldsymbol{\Lambda}$.

For every observation we observe the firm attributes, $\mathbf{Z}$, the prevailing choice characteristics, or "costs," contained in $\mathbf{X}$, and which of the three alternatives was selected. So we have to normalize the model for location and scale. We describe our normalization scheme in Appendix A. The model is connected to the data by the restriction that the chosen alternative provide the maximum indirect utility. Estimation of $\boldsymbol{\beta}$ in this hierarchical framework entails a first-stage "pseudo prior" that is a normal density whose mean and variance come from a linear projection onto the firm attributes (as evident in the data generating process). This is "updated" by the projection of the utilities onto $\mathbf{X}$ for each company. This is where firm fixed effects enter: for companies with more than one issue in the sample, we learn about $\boldsymbol{\beta}$ from these two distinct sources, with weightings determined by their relative variances. The second stage prior involves standard prior density specifications that are described in Appendix B.

2. Empirical Approach

2.1 Data

We use the SDC Global New Issues database to identify all public debt (non-convertible, including 144-A issues) and equity issues in the United States during the period January, 1980 through December, 1998.[6] Excluding all finance companies (SIC codes 6000 - 6999) and utilities (SIC codes 4900 - 4999), leaves 17,290 debt issues and 6,392 equity issues. We discard those cases where the same company issues two forms of capital within a two month time frame, leaving 10,094 issues: 1,945 short-term debt (with maturity less than 10 years), 3,368 long-term debt, and 4,781 equity issues. We eliminate issuers without valid data in the CRSP and Compustat databases. Next we eliminate all issues from non-incorporated entities such as limited partnerships, which survived the preceding filters. We eliminate all equity offerings where primary shares comprise less than 10% of the total offer.[7] Finally, we combine issues of the same class that fall within a one month span and average their properties. So, for example

[6] Fenn (2000) argues that public firms issue 144-A debt to gain flexibility and that these issues are otherwise identical to registered offerings. Gomes and Philips (2004) evaluate the public versus private capital choice, with a nested logit model of a two-stage choice. Issuers may issue public or private securities, and in each category, equity, convertibles or debt. They find that issuers characterized by high risk, low profitability, and large growth options are more likely to issue private securities, and issue equity (or convertibles). Their results suggest that conditional on issuing private securities, the effects of firm attributes on the form of issue are different from a public issuer. Their results also provide a warning against lumping private and public issuances together in studying capital structure change.

[7] This eliminates roughly 1% of the equity offerings (that survived the previous filters). Had we used a requirement that at least 50% of the offering be primary shares, we would have discarded some 10% of the equity issuers.

if IBM issued \$500 million in 2-Year notes with a yield of 8% on October 11, 1993 and \$500 million in 3-Year notes with a yield of 9% on October 14, 1993, we treat this as a \$1 billion 2.5-year 8.5% note issued on October 11.[8] Characteristics of the sample are shown in Tables 1 and 2. Our sample comprises 3,159 companies, who raise external capital a total of 6,448 times. Roughly half of the issues are equity and long-term debt is raised 70% more often than short-term debt.

2.2 Model Specification

Firm attributes are sample averages and thus assumed to be constant over an intermediate time frame (such as the 19-year period that we study). By contrast, the choice characteristics (costs) change continually. As noted, we test the extent to which the issuance decision depends on these costs. We measure the firm attributes ($\mathbf{Z}$) prior to each offering, and in cases where a company has more than one issue, we average the measured attributes over all issues to obtain the (single) relevant measure for that company. Our firm attributes (corresponding to columns 2 through 9 of $\mathbf{Z}$) are reported in Table 1A: 1) Firm size– the natural logarithm of the market value (in US\$ millions) of equity at year-end preceding the offering. 2) Quick Ratio– cash plus accounts receivable, divided by current liabilities, measured at year-end preceding the issue. 3) Fixed Assets–a measure of tangibility, being the ratio of property, plant, and equipment to total assets measured at year-end preceding the issue. 4) Market-to-Book–the market value of equity measured at month-end preceding the issue, divided by the book value of equity measured at year-end preceding the issue. 5) Profitability–quarterly earnings before interest, taxes, depreciation, and amortization (EBITDA) divided by total assets, measured at year-end preceding the issue. 6) Dividend yield–common equity's latest dividend per share (annualized) preceding the issue divided by price per share (taken from CRSP) at the end of the month preceding the issue. 7) CapEx–annual capital expense divided by total assets, measured at year-end preceding the issue. 8) R&D–the ratio of research and development expenditures to total sales, measured during the year preceding the issue. Thus the $\mathbf{Z}$ matrix is $(3,159 \times 9)$, and the $\mathbf{X}$ matrix is $(6,448 \times 5)$.

Standard patterns are evident in our sample. In Table 1A, we note that equity issuers tend to be smaller and more liquid than debt issuers. Equity issuers have higher research and development intensity than debt issuers, although the distribution of R&D is highly skewed (the median R&D expense is 0 for all three classes of issuers). Equity issuers tend to have

[8] To be clear, if the second issue in this example were a 15-year bond then both issues would have been discarded from the sample.

higher market-to-book ratios, much lower tangibility, and lower dividend yields than debt issuers. For the most part the debt issuers look alike although issuers of long-term debt are slightly more tangible, and have lower market-to-book ratios than the issuers of short-term debt. The variation in these attributes, even within the issue classes is very large. Also, note that the market-to-book ratio can be extremely large. We censor the data by putting a cap of 50 on this ratio.

Table 1B presents sample characteristics of the issue-specific cost (or $\mathbf{X}$) variables, along with other issue attributes, segmented by issue type. At the time of each issue, we measure the firm-specific costs of each alternative–both the one chosen, and the other two–as follows. To obtain after-tax debt costs, we use the firm's marginal tax rate from John Graham's website, for the issuer in the year preceding the issue.[9] For short-term debt, if the firm issued short-term debt we use the security's yield-to-maturity as the pre-tax cost. If the firm did not issue short-term debt, we use the Lehman Brothers index short-term corporate debt yield for the same bond rating as the issuer. If the firm issued debt at any point over the previous twelve months, we use the rating on that debt. Otherwise, we compute the firm's Z score and infer the rating by aligning the Z score with the Z score ranges of the ratings categories.[10] The costs of long-term debt are measured analogously. The firm's EBITDA-to-price ratio from the end of the month prior to the offering serves as the firm-specific cost of equity. We cap this variable at 50 and use this "censored equity" cost in our analysis.

We report separately the costs of the issued security and the costs for all issues–regardless of the chosen alternative. So the median cost of equity–for equity issuers is 9.3%, while this figure for all issuers is 13.8%. The median after-tax long-term debt yield for long-term debt issuers is 5.8%, while for all issuers this is 6.2%. The median after-tax short-term debt yield for all issuers is 5.7%.

We also report summary information on the market-wide conditions related to each of the choices in Table 1B. At the market-level, the short-term debt cost is the yield on the 90-day

[9]We are grateful to John Graham for supplying these tax rates. Since our focus is on the effect of issuing debt, we use the marginal tax rate that Graham computes based on income *before* interest expense has been deducted. The procedure uses Monte Carlo to account for the asymmetries and non-linearity in the tax code, and is described in Graham (1996a, 1996b) and Graham and Lemmon (1998).

[10]These ratings correspond to S & P classes: AAA, AA, A, BBB, and BB. Following Altman (1968), the Z score is computed as follows:

$$Z = \frac{3.3\mathrm{EBIT} + \mathrm{Sales} + 1.4\mathrm{RetainedEarnings} + 1.2\mathrm{WorkingCapital}}{\mathrm{TotalAssets}} + 0.6\frac{\mathrm{MarketValueofEquity}}{\mathrm{BookValueofTotalLiabilities}}.$$

US Treasury Bill, the long-term debt cost is the yield on the 10-year Treasury note, and the cost of equity is the earnings-to-price ratio of the S&P 500.[11] Debt issues tend to be larger than equity issues. The 75%ile of equity issue size is $46.8 million, whereas these values for short-term and long-term debt, respectively are $206.2 and $244.8 million. The median term-to-maturity of short-term debt is just over seven years, with the inter-quartile range of five to eight years. The distribution of long-term debt term is skewed with median, mean, and maximum of 12, 17, and 63 years, respectively.[12]

Table 1C provides the correlations between the choice-specific costs and key firm-specific attribute data. The long- and short-term debt costs are positively correlated at both the firm-specific and market levels. At the market level, equity cost is also strongly positively correlated with debt costs. However, the firm-specific cost of equity is virtually uncorrelated with the firm-specific debt costs. The correlation between the firm-specific and market-wide costs of equity is 21%. Turning to the pairwise correlations between the choice-specific cost data and the firm-specific attribute data (where we use the same attribute data for all of a firm's issues), we see that none of these exceed 50% in absolute value, and most are less than 25% in absolute value. The correlations between liquidity (quick ratio), research and development intensity, and market-to-book ratio, and the firm-specific cost of equity are each around -30%. The correlations between firm size, tangibility, profitability, and dividend yield, and the firm-specific cost of equity are each around 35%. Profitability and firm size are both negatively correlated with the firm-specific debt costs, at around -31%. Amongst the issuer-level attribute variables, some of the larger correlations are between profitability and R&D (-46%); liquidity and R&D (30%); profitability and R&D (-46%); size and dividend yield (48%); and (naturally) capital expenditures and tangibility (55%).

We report additional summary statistics for our sample in Table 2. The modal number of issues per firm is one, and 52 issuers have ten or more issues in our sample. 235 firms issue external, public capital five or more times in our sample. Most of the seasoned equity issuers (70%) raise equity only once. It is also clear that debt issuers raise both long-term and short-term debt over the sample period. There is a lot of variation from year to year in the number of public issues over our sample period. There is a noticeable drop in all offerings from 1986 to 1988–especially in long-term debt and equity. There were only 138 issues in 1988, following

[11]We obtained the S&P 500 data from Robert J. Shiller's webpage at Yale University.

[12]While it is natural to envision term-to-maturity as an issue-specific variable that, along with costs might influence the indirect utility of the alternative, we do not include the issue term as a choice attribute since it is a constant for equity, it would be tantamount to an instrumental variable that interacts with the equity intercept.

the October 1987 stock market crash, and 612 issues in 1997. There is similarly significant variation in the composition of offerings. For example, seasoned equity offerings accounted for over 83% of all issuances in 1983, and under 36% in 1998.

3. Results

We estimate the model using Gibbs sampling. The normalized model has two utility equations (Equations (A.1)), as short-term debt is the benchmark alternative. The Gibbs sampler solves the problem of estimating the model–integrating over a high dimensional state space, by sequential draws from the full conditional densities of all of the parameters and unobserved utilities (as described in Geweke 1997, or McCulloch and Rossi 1994). The relevant full conditional densities are provided in Appendix C. For all models, we discard the first 300,000 draws as a burn-in and the posterior densities for parameters and functions of the parameters are constructed from the next 30,000 draws.

3.1 Modeled Heterogeneity

Table 3 provides summary statistics from the posterior on $\mathbf{\Delta}$–the coefficient matrix that describes the projection of $\boldsymbol{\beta}$ onto the firm attributes ($\mathbf{Z}$). This matrix governs the extent to which elasticities and cost-of-capital-independent choices depend on firm attributes. The means of those coefficients for whom at least 95% of the posterior has the same sign as the mean are emboldened in the table. The coefficients on β_1 and β_2 show the (direct) effect of the firm attributes on the utility derived from long-term debt and equity, respectively, conditional on issue costs. The coefficients on β_3 show the effect of each of its attributes on the firm's sensitivity to the firm-level issue-specific cost. Similarly, the coefficients on β_4 show the effect of each of its attributes on the firm's sensitivity to the market-level issue-specific cost. To facilitate interpretation of the model coefficients, we transform the firm attribute variables by differencing them from their cross-sectional means. Thus the "Intercept" column reports the value of the relevant coefficient (β_1 through β_4) when the firm attributes are at their means. Both the β_1 and β_2 intercept terms are significant and positive, reflecting the higher number of long-term debt and equity offerings relative to short-term debt offerings in our sample. More importantly, the coefficients on both costs are negative and significant – suggesting that the model is consistent with constrained utility optimization and that the demand curve for each type of capital is downward sloping.

The estimated direct effects are generally consistent with earlier studies. For example *condi-*

tional on costs, smaller and more liquid firms derive more utility from (and hence are more likely to issue) equity, ceteris paribus. On the margin, we find that smaller firms prefer to issue long-term debt to short-term debt. More liquid firms also prefer to issue shorter-term debt over long-term debt. Firms with more capital expenditures prefer issuing short-term debt to long-term debt, and equity to debt. By contrast, more tangible firms prefer issuing long-term to short-term debt, and short-term debt to equity. Also, firms with more R&D intensity prefer to issue equity. Firms with higher dividend yields prefer long-term debt to short-term debt.

As noted, virtually all of the posterior mass on the intercepts of the cost coefficients (β_3 and β_4) is less than zero. The coefficient on the firm-specific costs (β_3) is slightly smaller on average, but has much lower dispersion than the coefficient on market-wide costs (β_4). The interquartile range of the mean firm-specific cost coefficient is $[-.14 \quad -.12]$, and the interquartile range of the mean coefficient on market conditions is $[-.18 \quad -.10]$. Since the $\mathbf{Z}$ (firm attribute) variables are differences from sample means, these coefficients are the expected values of the cost coefficients for average firm attributes. Several firm attributes have significant effects on the cost coefficients. Larger firms are more sensitive to issue-specific costs but size does not affect the sensitivity to market-wide conditions. More liquid firms are more sensitive to market-wide conditions and firm-specific issue costs. While we noted (Table 1A) that equity issuers tend to have higher market-to-book ratios than debt issuers, the market-to-book ratio does not enter the choice model significantly in any way. This result contrasts with earlier specifications, such as Jung, Kim, and Stulz (1996), where a higher market-to-book ratio was found to significantly increase the probability of issuing equity. There is no significant effect of either capital expenditures or R&D intensity on cost sensitivity. Only liquidity and dividend yield exert a significant effect on average sensitivity to market-wide market costs. Higher levels of each increase this elasticity. This dividend yield effect is consistent with Korajczyk and Levy (2003), who classify dividend-paying firms as financially unconstrained. They find that macroeconomic conditions account for over 38% to 48% of the time-series variation in issue choice for these firms, but only 22% to 24% for non-dividend-paying firms.

The more profitable or tangible a firm the less sensitive its choices are to firm-level cost-of-capital. This resembles a wealth effect seen in individual choices (Rossi, McCulloch and Allenby 1996). Earlier studies (e.g., Huang and Ritter 2009) have documented that more profitable firms are more likely to issue debt. However, it is also generally observed that more profitable firms tend to be *less* levered than less profitable firms. The positive coefficient on profitability in the β_2 equation means that, holding relative costs constant, more profitable firms prefer equity to debt. The cost of equity for more profitable firms will generally be higher (from Table 1C, the correlation between the firm-level cost of equity and profitability is 33%). This will militate toward choosing debt. However, this is offset by two factors, first and independent of the prevailing costs, more profitable firms prefer to issue equity over debt. Second, more profitable firms are less cost sensitive. The ultimate choice entails integrating over these three factors. Our model cannot explain why more profitable firms derive more utility from issuing equity, but it does provide a coherent link between the issuance choice problem and the puzzling fact that more profitable firms use less leverage.

3.2 Choice Probabilities

We obtain a more complete picture of issuance choice behavior by evaluating the choice probabilities implied by the model. The Gibbs sampler provides the exact posterior densities of these choice probabilities. For each Gibbs iteration, we construct the expected value of the (three-dimensional) $\mathbf{U}$-vector, using $\mathbf{\Delta}$ and $\mathbf{Z}$ to construct the expected $\boldsymbol{\beta}$, and the actual choice characteristics, $\mathbf{X}$. The relevant variance-covariance matrix is $\mathbf{\Lambda}$ (also available from the Gibbs iteration). Using these we take 100,000 draws from the tri-variate normal distribution to construct the choice probabilities.[13] The marginal posterior density of these probabilities is characterized by the 30,000 probability vectors (across all the Gibbs iterations).

In Table 4, we present attributes of the posterior distribution of expected choice probabilities of the three issues for the base case, where all three cost variables are equal to their sample mean values. All firm attributes are also set equal to the sample mean except for size, which is set at the sample mean plus one standard deviation. This makes the base case look more like the average issue rather than the average issuer (since small firms tend to show up only once in the sample). Here we have aggregated over all companies and issues in the sample, and the expected value of $\boldsymbol{\beta}$ is defined by the (Gibbs) draws from $\mathbf{\Delta}$, and the base-case firm attributes. In this base case, the medians of the posterior distribution of choice probability are: 17.1%, 35.0%, and 47.8% for short-term debt, long-term debt, and equity, respectively.

We obtain comparative statics by increasing each of the choice characteristic variables and firm attributes by one standard deviation, in turn. When the firm-specific cost of short-term debt goes from 6.119% to 8.562%, ceteris paribus, the median posterior probability of choosing short-term debt falls from 17.1% to 8.4%. At the same time, the median posterior probabilities

[13] We use an antithetic variate technique to reduce the numerical error introduced by using Monte Carlo to compute this integral.

of choosing long-term debt and equity increase from 35.0% to 39.0% and from 47.8% to 52.6%, respectively. When the firm-specific cost of long-term debt increases from 6.567% to 9.071%, the median expected probability of choosing long-term debt falls from 35.0% to 20.7%, with both equity and short-term debt becoming more attractive. When equity costs are 26.95%, one standard deviation above the sample mean of 15.87%, the median posterior mean choice probability for equity falls from 47.8% to 3.1%. In the base case, the 80%ile range for short-term debt, long-term debt, and equity are, respectively: 14.1% – 20.4%, 30.6% – 39.4%, and 41.9% – 53.7%. With the higher equity cost, these ranges become: 30.3% – 38.0%, 58.4% – 66.4%, and 1.4% – 5.9%, respectively.

Consider the effect of an increase in the yield-to-maturity on the 30-year Treasury Bond from 7.918% to 9.945% (which can be viewed as a steepening of the yield curve). In this event, for our mean firm, the median probability of issuing long-term debt falls from 35.0% to 27.7%, while the probabilities of issuing both short-term debt and equity rise proportionately. When faced with market-wide equity costs of 8.806% instead of 6.355%, the probability that the base-case firm will issue equity falls from 47.8% to 37.8%.

We report two effects for the comparative statics on firm attributes. We measure the direct effect by isolating the effect of the change in the firm's attribute on the intercepts in the utility equations only. We measure the total effect by allowing all of the coefficients in the utility equation to be affected by the changed element in the $\mathbf{Z}$ vector. As a firm differs from our base-case firm, its issue choice– independent of the relative costs–may be different; but so too might its cost sensitivity. So, for example, when we use log-firm size of 10.43 instead of 8.35, we see a big shift in preferences away from equity. The median expected choice probability of equity issuance falls from 47.8 to 3.9% in this case. We decompose this change into the drop from 47.8% to 8.4% attributable to larger firms' unconditional higher preference for debt, and from 8.4% to 3.9% attributable to the fact that larger firms are more sensitive to both firm-specific issue costs, and market-wide conditions (as seen in Table 3), evaluated at the means of these measures.

When we increase the representative firm's quick ratio by one standard deviation the probability of choosing equity rises from 47.8% to 55.3%. In this case almost all of this effect is independent of the relative costs (both firm-specific and market-wide). However, the term of the debt is altered by the change in cost sensitivity. More liquid firms are more sensitive to relative costs, which in the base case environment of an upward sloping yield curve, increases the appeal of short-term relative to long-term debt. But this effect is overwhelmed by the fact that more liquid firms prefer long-term debt to short-term debt unconditionally.

Increasing tangibility by one standard deviation raises the probability of choosing long-term debt from 35% to 49.7%. The median posterior probability of issuing short-term debt also increases (from 17.1% to 18.7%). In this case, the cost sensitivity effect dampens the direct effect. If this change in our firm's profile had no effect on relative cost sensitivity, then the effect on the probability of long-term debt issuance would be even larger; as we saw in Table 3, an increase in tangibility means that the firm is less sensitive to firm-level costs-of-capital.

We confirmed in Table 3 that the higher a firm's profitability, the more it prefers equity, independent of the relative costs. The scope of this effect is available from Table 4. Increasing profitability by one standard deviation *holding the choice characteristics fixed* raises our firm's probability of issuing equity from 47.8% to 77.4%. Of this total, the increase from 47.8% to 70.8% (or three-quarters of the total effect) is independent of the cost sensitivity.

Aside from size, R&D intensity has the biggest direct effect. If our base-case firm's R&D intensity increases by one standard deviation, the probability of it issuing equity is 71.8% (compared to the base care of 47.8%). But, if we remove the change in cost sensitivity, the probability of issuing equity would be 81.7%. In this case, the effect of the change in R&D on cost sensitivity is virtually completely a trade-off between equity and long-term debt. As such, the effect is not evident in Table 3 where each of these two choices is evaluated relative to short-term debt.

We also analyze the model's choice probabilities away from the base-case firm. This is accomplished in Figures 1, 2, and 3, and Table 5. The figures show the joint effects of changing a choice-specific (cost) variable and a firm attribute variable, for a firm whose other variables are set to the sample averages, on the posterior median probabilities of issuing the indicated form of capital. Figure 1 shows the effects of the firm-specific cost of equity on equity issuance for varying levels of profitability (left-hand panel), and firm size (right-hand panel). The most unprofitable firm considered (with profitability of -.17) has a 99%, 71%, and 2.5% (mean posterior) probability of issuing equity, as the cost of equity ranges from 4.3% to 15% to 29%. (Recall that the mean and standard deviation of the firm-specific cost of equity are 15.7% and 10.4%.) For the most profitable firm considered (with profitability of 0.46), the mean posterior probabilities of equity issuance range from: 100%, to 91%, to 80%, as the cost of equity ranges from 4.3% to 29.54% to 36.51%. When profitability is high, it takes a high cost of equity to discourage equity issuance. And when the firm-specific equity cost is low, the firm will issue equity regardless of its profitability. The Gibbs sampler allows us to construct the entire posterior densities of these choice probabilities. For example for the three specific cases above for the most unprofitable firm, the 80% posterior bands on the probabilities of equity issuance are: [98% 100%], [61% 80%], and [0% 10%], respectively. The right-hand panel of Figure 1 shows that small firms tend to issue equity regardless of their equity capitalization rates. By contrast, very large firms show a strong predilection for debt. Mid-size companies' demand for financing type is very cost elastic. For example, consider the otherwise average firm in the fifth size octile. When its equity capitalization rate is 7.8%, the 90%ile posterior band on the probability of issuing equity is [97% 99%]. When the equity capitalization rate is 14.8%, this band is [83% 91%] when the equity capitalization rate is 21.7%, this band is [45% 64%] and when the equity capitalization rate is 28.7%, this posterior band is [10% 30%].

The left-hand panel of Figure 2 shows the median posterior probabilities of issuing short-term debt as firm size and firm-level after-tax long-term debt costs vary, for an otherwise mean firm. The smaller half of firms virtually never issue short-term public debt, and larger firms are increasingly sensitive to the cost of the substitute. Consider a firm in the largest octile. When its after-tax long-term debt yield is 5.7% (45 basis points less than the after-tax yield on short-term debt), it will issue short-term debt 35% of the time, with 95% posterior band, [28% 42%]. When its long-term debt cost is 6.9% (75 basis points more than short-term debt costs and 880 basis points lower than the equity capitalization rate), its probability of issuing short-term debt is 44% [38% 51%]. When its after-tax long-term debt yield is 8.47% (235 basis points higher than short-term debt), its probability of issuing short-term debt is 58% [50% 65%].

The right-hand panel of Figure 2 shows the median posterior probability of issuing long-term debt for varying levels of tangibility and the firm's equity capitalization rate. We see that long-term debt becomes relatively more attractive as the equity capitalization rate rises, for all levels of tangibility. But it is also clear that for a given cost of equity (especially when the equity capitalization rate is 14.8% or higher), more tangible firms are more likely to issue long-term debt.

The left-hand panel of Figure 3 shows the median posterior probability of issuing long-term debt as a function of dividend yield and the earnings-price ratio of the S&P 500. As dividend yield increases, long-term debt becomes relatively more attractive–particularly when the market has a low price-earnings multiple. High-yield firms are very likely to issue long-term debt, when the market equity capitalization rate is high. The right-hand panel of Figure 3 shows the median posterior probability of issuing long-term debt as a function of quick ratio and the earnings-price ratio of the S&P 500. As suggested by Table 3, the sensitivity of issuance choice to market-wide capital costs increases in dividend yields. Similarly, more liquid firms (those with higher quick ratios), are more sensitive to market-level capital costs. We see that less liquid firms have a higher probability of issuing long-term debt than liquid firms when the aggregate price-earnings ratio is high. Conversely when the market's price-earnings multiple is low, more liquid firms have a higher probability of issuing long-term debt than the least liquid firms.

Attributes of the posterior distributions on the choice probabilities are presented in Table 5 for 26 randomly selected issues. The first ten of these issues are from firms with singleton issues in our sample, while the rest are from firms with multiple issues in the sample. For example, Firm 1 (Sippican) issued equity in 1983. The median posterior probabilities for choosing short-term, long-term debt and equity are 0%, 0%, and 100%, respectively. These choice probability posterior distributions tend to be skewed, especially when the median is close to a boundary. For example, the 10%ile, median, and 90%ile probability of equity in the case of Robert Bruce Industries' long-term debt issue are: 0%, 1.3% , and 55%, respectively. The posterior distribution for the probability of issuing either long-term or short-term debt is available by subtracting the equity probability from 1. Amongst the ten equity issuers in the table, the lowest median posterior probability of an equity issuance is 98.8% for Ames Department Store for whom the 10%ile posterior probability of equity issuance is 78.4%.

3.3 Information in Issuance Data: Firm Fixed Effects

In this subsection, we evaluate the value of the information in an issuer's other choices for modeling a particular issue. The full conditional density of $\boldsymbol{\beta}$ (shown in Appendix C) has two parts. For a firm with only one issue, we learn about its $\boldsymbol{\beta}$ only from its demographic data and the cross-section of firms (i.e., through $\boldsymbol{\Delta}$). For a firm with multiple issues, that information is combined with the covariances between that firm's indirect utilities and the choice characteristics for each of its choices. Lemmon, Roberts, and Zender (2008) suggest that unmodeled (or at least unmeasured) heterogeneity (a firm-level fixed effect) is the most important determinant of leverage. If that is also true for firms' issuance choices, then it should be the case that when we do not condition on a firm's other choices, the posterior choice probabilities are much less accurate and precise than when we do condition on these other choices. To this end we treat each issue (from companies making multiple issues), as a singleton issue. Next we condition on Δ, Λ, and V_β, (drawn as above), and then draw y and β, from the alternate data.[14]

Table 5 shows the role for firm fixed effects for 16 individual issuers, and Table 6 aggregates this across all firms with multiple issues. In Table 5 the "RI" rows are constructed from the reduced information set. For example, Company 24 (Anheuser-Busch) has 13 separate issues in our sample. We isolate its long-term debt issue in 1993 in Table 5. The first row is the posterior on choice probabilities constructed from all sample information. The second (RI) row is estimated by using all sample information from all other firms in the sample, but only this one issue for Anheuser-Busch. In this case the information from multiple issues tightens the posterior distributions on choice probabilities and improves on the model's (predictive) accuracy. Using only cross-sectional information for this Anheuser-Busch issue, the 80%ile band on the observed choice is [19% 89%]. When we also condition on the firms' additional choices, this is [41% 91%]. In this case, the median probability of the long-term debt (the observed choice) is 70% when all information is used, and 56% when the other 12 choices are not used in updating beliefs. Furthermore, the median posterior probability of debt falls from 100% in the full information case to 93% in the reduced information case.

Consider company 22 (Pennzoil). This company has 10 issues in our sample. We isolate its long-term public debt issuance in 1987 in Table 5. When we condition on both this firm's other choices as well as the cross-sectional information to update prior beliefs, the median posterior probability of debt is 87.2%, and the median posterior probabilities of short- and long-term debt are 9.9% and 73.7% respectively. The 90%ile of the posterior probability of issuing short-term debt is 24.0%. When we discard the information from the other nine choices made by this company, the median probability of a debt offering is essentially unchanged, however the 80%ile posterior band of the probability of debt issuance is [41% 100%] versus [65% 97%] in the full information case. For this issue, the additional information contained in this company's other choices is most useful in discriminating between long- and short- term debt. When we learn about Pennzoil's preferences exclusively from the cross-section of firms, the 80%ile posterior band on issuing short-term debt is [3.8% 62.9%]. By adding Pennzoil's nine other choices to the information set this band becomes [2.7% 24.0%], with the probability shifting entirely to

[14] Specifically we take 30,000 burn-in draws for y and β conditional on the first draws of the other parameters in the posterior, and then proceed sequentially through the remaining 29,999 draws in turn.

the actual choice (long-term debt).

Table 6 reports the averages from the firm-level posterior distributions on the choice probabilities. The pattern seen with Anheuser-Busch and Pennzoil is also evident in aggregate for long-term debt and equity issuers. For example, across the 2,140 equity issues from the multiple issuers, the (cross-sectional) average posterior-mean (median) probability of equity issuance is 65% (69%) when we do not condition on the issuers' other issues. The mean standard deviation of this posterior is 26%, and the mean 90%ile band is [17% 99%]. When we condition on the other issues by these issuers, the average posterior mean (median) for equity issuance is 85% (92%), the mean posterior standard deviation is 12%, and the average 90%ile band is [64% 96%].

There are 1,552 long-term debt issues by the multiple issuers. For this group, the information in firms' other issues contributes to more accurate and precise posterior choice probabilities. By adding this information to the conditioning set, the (cross-sectional) average posterior-mean probability of issuing long-term debt increases from 54% to 64%, the average standard deviation of this probability shrinks from 24% to 17%, and the mean 90%ile band decreases from [11% 91%] to [34% 88%].

By contrast, while the information in issuers' other issues increases the precision, it does not increase the accuracy of the posterior probabilities of short-term debt issuers–as concerns debt term. When we add the information in the issuers' other issues, the cross-sectional average posterior of the 90%ile range goes from [5% 94%] to [20% 78%]. The mean of the probability of a short-term debt issue falls from 54% to 48%. This reduction in accuracy for short-term debt issuers does not apply to the choice of debt versus equity. When we add issuers' other choices to the conditioning set, the average posterior mean probability of issuing equity in these short-term debt issues falls from 19% to 13%. The mean 75th and 95%ile values of the probability of issuing equity fall from 31% and 66% to 18% and 36%, respectively.

Overall the results in Tables 5 and 6 show that Lemmon, Roberts and Zender's (2008) conclusion concerning the importance of unmodeled (or unmeasured) heterogeneity or firm-specific determinants for capital structure also apply to the issuance choice between debt and equity. Consider a gamble that pays off $1 when the indicated issue occurs. Suppose that these are priced according to the proportion of each issue within the multiple issuer sample: equity: $0.46, long-term debt: $0.34, and short-term debt $0.20. Assuming that you could only buy one ticket and that you are risk-neutral, then you would be willing to pay $0.22 for the choice model and the cross-sectional data. You would be willing to pay an additional \$0.12 for all of the firms' other choice data.

3.4 Variance Decompositions

In this section we examine the unique information pertaining to the issuance choice that is contained in the firm attribute and cost data by comparing the explanatory power of our unconstrained model to three constrained versions of the model. Table 7 reports these variance decompositions. We define $\rho^2(U_i)$ from the base model as one minus the ratio of the unexplained variation for each of the two alternatives (relative to the benchmark), ($i = l$ (long-term debt) and $i = e$ (equity)), $\Lambda_{i,i}$, to the total variation in that choice, $\sigma^2(U_i)$. The base model explains 94% of the heterogeneity of the equity choice and 52% of the heterogeneity associated with the debt term choice. The posterior densities of ρ^2, imply that they are estimated precisely–especially the $\rho^2(U_e)$. In the first constrained model, reported in the block labeled "Intercepts Only," the sensitivities to costs are constrained to be zero. Under this specification, the intercepts in both equations are allowed to depend on the firm attributes, and β_3 and β_4 in Equations (A.2) are restricted to zero. The second set of restrictions involves setting $\mathbf{\Delta}_{1,j}$ and $\mathbf{\Delta}_{2,j}, j = 2, \ldots 9$, in Equations (A.2) to zero, and $\mathbf{\Delta}_{1,1}$ and $\mathbf{\Delta}_{2,2}$ in Equations (A.2) to unity. This has the effect of constraining the intercepts in the choice equations to be constant across firms; in this case, the modeled heterogeneity in choices comes only from firms' sensitivities to costs and the differences in those costs. In the final restricted specification, headed, "Intercepts and Market Conditions Only," we allow the intercepts in both equations to depend on the firm attributes, and allow the indirect utilities to depend on the market-wide–but not the firm specific–costs. Thus, β_1, β_2, and β_4 in Equations (A.2) are unrestricted, and β_3 is restricted to zero.

Comparing the "Intercepts Only" case to the Base Model reveals that the heterogeneity in the intercepts–arising from the firm attributes–accounts for $\frac{79\%}{94\%}$, or 84% of the total modeled variation in the equity choice. This suggests that most of the debt vs. equity decision depends on the type of firm the issuer is: At most the market costs at the time of issuance account for only 16% of the explained variation in the indirect utility from equity. Turning to the debt term choice, we see that firm attributes account for maximally 59% ($\frac{32\%}{54\%}$) of the modeled heterogeneity in this choice. The information contained in the market-based cost-of-capital measures–both at the market level, and at the firm level– explains up to 41% of the total explained variation in the indirect utility from long-term debt. Using the posterior distributions of both ρ^2 values, the 90% posterior band on the maximal percentage that market conditions exert on the total explained variation in equity choice is [13% 20%] for the average issue. This band for the debt term choice is [24% 53%].

Next we examine the extent to which the choice characteristics–i.e., the market costs and aggregate market conditions–comprise a sufficient statistic to explain capital issuance by our average firm. Comparing the explained heterogeneity from the "Choice Characteristics Only" specification with the full model shows that firm attributes contribute 7.5% of the explained variation in equity choice ($1 - \frac{87\%}{94\%}$). Similarly, 17% of the explanatory power of the full model for the indirect utility of long-term debt is lost by forcing the intercepts to be constant across the firms.

The third comparison is between the ρ^2 values in the "Intercepts and Market Conditions Only" setting with the "Intercepts Only" case. Since market-level costs are the same for all issuers, and they are not affected by issuer behavior, this isolates the scope of a potential capital markets channel. Market-level information accounts for an incremental explanatory power of 3% (being $[1 - \frac{79\%}{94\%}] - [1 - \frac{82\%}{94\%}]$) in the equity choice, with 90%ile posterior band [0% 8.5%]. The posterior mean and 90%ile posterior band on the bounds for the debt term choice are 28% and [9% 44%].

On average, the two types of variables–fixed firm attributes and time-varying choice characteristics–exhibit a high degree of redundancy with respect to explaining observed capital choices. This is especially true as concerns the utility that firms derive from issuing equity. Nevertheless, it is clear that prevailing market costs affect average issuance behavior. This effect is much stronger on issuers' choice of debt term than on the choice of debt versus equity. Indeed at the market-level there is material posterior mass on the hypothesis that the indirect utility of equity (and hence the probability of equity issuance), is not affected by the price-earnings multiple of the overall stock market, and the slope of the yield curve. By contrast these macroeconomic variables have a significant incremental effect on issuers' choice of debt term.

3.5 Heterogeneity

We report properties of the posterior distributions of the model's scale parameters in Table 8. Panel A shows the posterior on $\mathbf{\Lambda}$, the variance-covariance matrix of the random utilities. The model was normalized by restricting the variance of the utility from long-term debt to unity. If the underlying utilities from long-term debt and equity are independent, then after normalization, the correlation would be 0.5. The prior on this off-diagonal element is diffuse, but centered on 0.5, the posterior is fairly tightly centered around 0.5. The posterior variation in the utility from equity is of similar magnitude as the (normalized) variation in utility from long-term debt.

Panels B and C of Table 8 characterize the extent to which the eight firm attribute variables explain the cross sectional variation in $\boldsymbol{\beta}$. $\mathbf{V}_{\boldsymbol{\beta}}$ is the portion of the variation in $\boldsymbol{\beta}$ that is not attributable to firm attributes. So from Panel C, we note that over 50% of the variance in the intercept in the equity utility equation is explained by firm characteristics. Projecting the $\boldsymbol{\beta}$ onto the firm attributes ($\mathbf{Z}$) explains some 20% of the variation in the coefficient on market-wide conditions, 11% of the variation in the coefficient on firm-specific costs, and 14% of the variation in the utility of long-term debt. Overall, these results suggest that firm attributes are much more important in distinguishing between equity and debt than they are in distinguishing between long-term debt and short-term debt. Further, choice history is more important than firm attributes in measuring the firm's sensitivity to its own direct issuance costs.[15]

4. Conclusion

We model public corporations issuing public capital as utility maximizers. The simple market cost of an alternative negatively impacts the indirect utility from that alternative. Our specification and results are consistent with recent survey evidence on issuance behavior. Graham and Harvey (2001) report that 46% of the CFOs in their survey say that they issue debt when interest rates are low; and 67% of the survey respondents say that equity issuance depends on over/under-valuation by the market. By using the statistical analysis of choice, we manage some of the concerns that plague survey evidence, including selection bias and sample size.

We use our choice model to explore the nature of the demand curves for external capital. More profitable firms prefer equity unconditionally and are less sensitive to relative capital costs. Larger firms and firms with more tangibility (fixed assets as a percentage of total assets) are also more sensitive to firm-level issue costs. More liquid firms are more sensitive to both firm-level and market-level issue costs, and firms with higher dividend yields are more sensitive to market-level issue costs. By contrast the lower price elasticity of more profitable and tangible

[15]It is perhaps telling to compare the relative importance of firm attributes versus choice history in this analysis to similar studies of consumer choice. Rossi, McCulloch and Allenby (1996), for example, find that household demographics explain only 7% of price sensitivity in their study of household tuna fish purchases, noting that this is larger than the explained effect in earlier studies of consumer purchase behavior.

firms may indicate that such firms face non-pecuniary costs of different types of capital. Put differently, the market-based measures that we use to characterize the cost of each form of capital may be less relevant for very profitable firms.

We characterize the information contained in the model by comparing the efficacy of its predictions to historical ratios. We aggregate all firms with more than one issue in the sample, and then decompose the information contained in the data via the model into two parts. First cross-sectional information, and second firm-specific information. We summarize this using a lottery-like bet with the price for each choice set equal to its proportion in the sample, so that the sum of the costs of each of the three tickets is \$1. A risk-neutral gambler constrained to buy only one ticket, would be willing to pay 36¢ for the model–22¢ for the cross-sectional model and data, and 12¢ for the additional choices by each firm. So as concerns the issuance choice firm-level (or fixed) effects account for one-third of the total variation in observed behavior.

Appendix A: Normalization of the Model

In Section 1 of the text, we show the data generating process to help build intuition. Because the utilities from the three choices are unobserved, the model is unidentified. Identification (and estimation) require that it be normalized. Since we observe the choice and not the actual indirect utilities, adding a constant to each sampled utility would be observationally equivalent to the original problem. We handle this location indeterminacy by subtracting the first choice equation from each of the other choice equations. This results in the following two utility equations for issue p_i , by firm i:

$$
\begin{aligned}
U^*_{i,p,l} &= (\beta_{i,l} - \beta_{i,s}) + \beta_{i,4}(X^f_{i,p,l} - X^f_{i,p,s}) + \beta_{i,5}(X^m_{i,p,l} - X^m_{i,p,s}) + (\epsilon_{i,p,l} - \epsilon_{i,p,s}) \\
U^*_{i,p,e} &= (\beta_{i,e} - \beta_{i,s}) + \beta_{i,4}(X^f_{i,p,e} - X^f_{i,p,s}) + \beta_{i,5}(X^m_{i,p,e} - X^m_{i,p,s}) + (\epsilon_{i,p,e} - \epsilon_{i,p,s})
\end{aligned}
\tag{A.1}
$$

For notational convenience, we rewrite this system as follows:

$$
\begin{aligned}
U^*_{i,p,l} &= \beta^*_{i,l} + \beta_{i,4}(X^f_{i,p,l} - X^f_{i,p,s}) + \beta_{i,5}(X_{i,p,l} - X^f_{i,p,s}) + \epsilon^*_{i,p,l} \\
U^*_{i,p,e} &= \beta^*_{i,e} + \beta_{i,4}(X^f_{i,p,e} - X^f_{i,p,e}) + \beta_{i,5}(X^m_{i,p,e} - X^m_{i,p,s}) + \epsilon^*_{i,p,e}
\end{aligned}
\tag{A.2}
$$

$$\epsilon^* \sim N(\mathbf{0}, \mathbf{\Lambda}^*)$$

Now, the elements of (2×2) matrix Λ^* are transformed as follows:

For the diagonal elements:

$$
\begin{aligned}
\Lambda^*_{1,1} &= \Lambda_{1,1} + \Lambda_{2,2} - \Lambda_{1,2} - \Lambda_{2,1} \\
\Lambda^*_{2,2} &= \Lambda_{1,1} + \Lambda_{3,3} - \Lambda_{1,3} - \Lambda_{3,1}
\end{aligned}
$$

For the non-diagonal elements:

$$\Lambda^*_{1,2} = \Lambda^*_{2,1} = \Lambda_{1,1} - \Lambda_{1,2} - \Lambda_{1,3} + \Lambda_{2,3}$$

And, the elements of (4×4) matrix $\mathbf{V}^*_{\boldsymbol{\beta}}$ are:

For the first (2×2) sub-matrix:

The diagonal elements are :

$$\mathbf{V}^*_{\boldsymbol{\beta}}(1,1) = \mathbf{V}_{\boldsymbol{\beta}}(1,1) + \mathbf{V}_{\boldsymbol{\beta}}(2,2) - \mathbf{V}_{\boldsymbol{\beta}}(1,2) - \mathbf{V}_{\boldsymbol{\beta}}(2,1)$$
$$\mathbf{V}^*_{\boldsymbol{\beta}}(2,2) = \mathbf{V}_{\boldsymbol{\beta}}(1,1) + \mathbf{V}_{\boldsymbol{\beta}}(3,3) - \mathbf{V}_{\boldsymbol{\beta}}(1,3) - \mathbf{V}_{\boldsymbol{\beta}}(3,1)$$

The off-diagonal elements are:

$$\mathbf{V}^*_{\boldsymbol{\beta}}(1,2) = \mathbf{V}^*_{\boldsymbol{\beta}}(2,1) = \mathbf{V}_{\boldsymbol{\beta}}(1,1) - \mathbf{V}_{\boldsymbol{\beta}}(1,3) - \mathbf{V}_{\boldsymbol{\beta}}(1,3) + \mathbf{V}_{\boldsymbol{\beta}}(2,3)$$

For the latter (2×2) sub-matrix:

The diagonal elements are:

$$\mathbf{V}^*_{\boldsymbol{\beta}}(3,3) = \mathbf{V}_{\boldsymbol{\beta}}(4,4)$$
$$\mathbf{V}^*_{\boldsymbol{\beta}}(4,4) = \mathbf{V}_{\boldsymbol{\beta}}(5,5)$$

The off-diagonal elements are:

$$\mathbf{V}^*_{\boldsymbol{\beta}}(3,4) = \mathbf{V}_{\boldsymbol{\beta}}(4,5)$$
$$\mathbf{V}^*_{\boldsymbol{\beta}}(4,3) = \mathbf{V}_{\boldsymbol{\beta}}(5,4)$$

But still the model is not identified up to a multiplicative constant. There are different ways of dealing with this. Historically, the most common is to normalize the (1,1) element of Λ to unity. This of course means that all terms in the transformed utility equations are divided by the square-root of $\Lambda^*_{1,1}$. Thus, all the $\boldsymbol{\beta}$ coefficients in the last system are divided by $\sqrt{\Lambda^*_{1,1}}$. The effect of these 2 normalizations on Δ are as follows: for the first $i = 1, 2$ rows of Δ:

$$\Delta^*_{i,j} = \frac{\Delta_{i+1,j} - \Delta_{1,j}}{\sqrt{\Lambda^*_{1,1}}} \quad j = 1, \ldots 9.$$

For the $i = 3$, 4 rows of Δ:

$$\Delta^*_{i,j} = \frac{\Delta_{i+1,j}}{\sqrt{\Lambda^*_{1,1}}} \quad j = 1, \ldots 9.$$

Since we do not observe the utilities associated with the alternatives, estimation involves integrating over this space (defined by a truncated multivariate normal distribution). As an example, if equity were chosen, then we know that the utility associated with equity is positive (since we normalized short-term debt to zero), and furthermore that this utility is greater than the utility of long-term debt. We use Gibbs sampling to sequentially sample through the space defined by the latent utilities and parameters. The algorithm along with the prior and full conditional densities sampled in each draw are described in Appendices B and C. By sampling from the full conditional densities in turn, we construct the posterior of the model parameters (and utilities). An attractive byproduct of the Gibbs sampler is that the marginal posterior of any function of interest can be constructed by evaluating that function at each of the Gibbs draws, with the set of functions determining the posterior.

Appendix B: Second Stage Priors

As noted in the text, the hierarchical model involves standard prior densities as the second stage. Note that convergence of the Gibbs sampler in this case requires proper priors. Also note that we use the same prior structure as in Rossi, McCulloch and Allenby (1996), which is intricately linked to the normalization scheme shown in Appendix A.[16]

Prior on $\mathbf{\Lambda}$. This is the residual variance-covariance matrix from the projection of the utilities onto the $\mathbf{X}$ matrix. It is assumed that this is the same for all companies in the population.

$$\mathbf{\Lambda}^{-1} \sim \text{Wishart}(\lambda_{[i,j]}, \nu) \tag{B.1}$$

We set $\lambda_{[2,2]} = 1$; and $\lambda_{[1,2]} = 0.5$. (Recall that $\lambda_{[1,2]}$ is normalized to unity, and if the actual residuals from this projection are uncorrelated then after normalization $\lambda_{[1,2]}$ will be 0.5.)

We set $\nu = 1600$ (contrast to the sample size of 6,448).

Prior on $\mathbf{V}_{\boldsymbol{\beta}}$. This is the variance-covariance matrix of the $\boldsymbol{\beta}$ vector.

$$\mathbf{V}_{\boldsymbol{\beta}_0}^{-1} \sim \text{Wishart}(vb_{[i,j]}, \nu_{\beta_0}) \tag{B.2}$$

We set $vb_{[i,i]} = 2.5$, $(i = 1, \ldots, 4)$, and $vb_{[i,j]} = 0.5$, $(i = 1, \ldots, 4, j = 1, \ldots, 4,\ i \neq j)$. We set $\nu_{\beta_0} = 5$.

Prior on $\mathbf{\Delta}$. $\text{vec}(\mathbf{\Delta}) \sim N(\overline{\text{d}}, (\mathbf{V}_{\boldsymbol{\beta}} \otimes \mathbf{A}_d^{-1}))$. We set $\overline{\text{d}} = 0$, and $\mathbf{A}_d = 0.01 \cdot \mathbf{I}_9$. For the purposes of Appendix C, define $\overline{d} = vec(\overline{D})$ (where $\overline{D}$ is of dimension $N \times 9$).

[16]This is the same prior/identification scheme used in McCulloch and Rossi (1994). McCulloch, Polson, and Rossi (2000) review this approach and present an alternative. See also Nobile (1998), and Imai and Van Dyk (2005), for alternative prior/identification approaches.

Appendix C: Conditional Densities used in the Gibbs Sampling

The Gibbs sampler affords an efficient way to integrate over a high dimensional state space. In this context we sample from the full conditional density of each parameter and latent utility in turn. Since we have used conjugate (proper) priors each of the conditional densities is available in closed form. The hierarchical structure of the prior is evident since there is no prior on $\boldsymbol{\beta}$. Below it is clear that the draw from $\boldsymbol{\beta}$ treats the projection of the $\mathbf{U}$ on $\mathbf{X}$ as the "likelihood," and $\boldsymbol{\Delta}\mathbf{z_i}$, using the firm's attributes (the 9-dimensional vector of firm i's attributes, $\mathbf{z}_n$), and its membership in the population (the 4×9 matrix $\boldsymbol{\Delta}$), to form the second-stage "prior."

Full Conditional density of $U_{i,p,j}$. Since conditional on $\mathbf{X}$, $\mathbf{Z}$, and $\boldsymbol{\beta}$, the firms are independent and all choices–whether by a single, or across all firm(s) are independent, we draw each set of $\mathbf{U}$ separately using a truncated normal that specifies that the observed choice in each case has the highest utility. If short-term debt is chosen, (the numeraire choice), then both U_1 and U_2 must be negative. If long-term debt is chosen then U_1 must be positive and greater than U_2. The mean of this truncated normal vector is $\mathbf{X}\boldsymbol{\beta}$ and the variance-covariance matrix is $\boldsymbol{\Lambda}$.

Full Conditional density of $\boldsymbol{\beta}$. Conditional on the choice characteristics, $\mathbf{X}$, the firm choices are independent, so we have:

$$\boldsymbol{\beta}_i \sim N(\overline{\mathbf{b}}\ ,\ (\mathbf{X}_i'\boldsymbol{\Lambda}^{-1}\mathbf{X}_i + \mathbf{V}_{\boldsymbol{\beta}}^{-1})^{-1})$$

$\mathbf{X}_i$ is the $2 \cdot P_i \times 4$ matrix of the P_i stacked $\mathbf{X}$ matrices for company i.

$$\overline{\mathbf{b}} = (\mathbf{X}_i'\boldsymbol{\Lambda}^{-1}\mathbf{X}_i + \mathbf{V}_{\boldsymbol{\beta}}^{-1})^{-1}[\mathbf{X}_i'\boldsymbol{\Lambda}^{-1}\mathbf{X}_i\hat{\boldsymbol{\beta}}_i + \mathbf{V}_{\boldsymbol{\beta}}^{-1}\overline{\boldsymbol{\beta}_i}]$$

$$\overline{\boldsymbol{\beta}_i} = \boldsymbol{\Delta}\mathbf{z}_i$$

$$\hat{\boldsymbol{\beta}}_i = (\mathbf{X}_i'\boldsymbol{\Lambda}^{-1}\mathbf{X}_i)^{-1}\mathbf{X}_i'\boldsymbol{\Lambda}^{-1}\mathbf{U}_i$$

Full Conditional density of $\boldsymbol{\Lambda}$.

$$\hat{\boldsymbol{\Lambda}}^{-1} \sim \text{Wishart}(\nu + T, \boldsymbol{\Gamma} + \boldsymbol{\Sigma})$$

$$\Lambda_{[i,j]} = \hat{\Lambda}_{[i,j]}/\hat{\Lambda}_{[1,1]}$$

where: $\mathbf{\Sigma} = \sum_{t=1}^{T} \boldsymbol{\epsilon}_t^{'} \boldsymbol{\epsilon}_t$;   and $T = \sum_{i}^{N} P_i$.

Full Conditional density of $\mathbf{\Delta}$.

$$vec(\mathbf{\Delta}) \sim N(\tilde{d}, (\mathbf{V}_{\boldsymbol{\beta}} \otimes (\mathbf{Z}^{'}\mathbf{Z} + \mathbf{A}_d)^{-1})$$

where:

$\tilde{\mathbf{d}} = vec(\tilde{\mathbf{D}})$, and $\tilde{\mathbf{D}} = ((\mathbf{Z}^{'}\mathbf{Z} + \mathbf{A}_d)^{-1}(\mathbf{Z}^{'}\mathbf{Z}\hat{\mathbf{D}} + \mathbf{A}_d\overline{\mathbf{D}})$,

$$\hat{\mathbf{D}} = (\mathbf{Z}^{'}\mathbf{Z})^{-1}\mathbf{Z}^{'}\mathbf{B},$$

$\mathbf{B}$ is the $N \times 4$ matrix with each company's $\boldsymbol{\beta}_i^{'}$ as a row, $\mathbf{Z}$ is the $N \times 9$ matrix with each company's $\mathbf{z}_i^{'}$ as a row.

Full Conditional density of $\mathbf{V}_{\boldsymbol{\beta}}$.

$$\mathbf{V}_{\boldsymbol{\beta}}^{-1} \sim \text{Wishart}(\nu_{\beta_0} + N, \mathbf{V}_{\boldsymbol{\beta}_0}\mathbf{S})$$

where: $\mathbf{S} = \sum_{i=1}^{N} (\boldsymbol{\beta}_i - \overline{\boldsymbol{\beta}}_i)^{'}(\boldsymbol{\beta}_i - \overline{\boldsymbol{\beta}}_i)$;   and $\overline{\boldsymbol{\beta}}_i = \mathbf{\Delta}\mathbf{z}_i$.

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Table 1A
Summary Statistics for Firm Attributes

This table reports summary statistics for firm attributes: *Size* is the log of the market value of the firm's equity (in US$ millions); *Quick Ratio* is the ratio of cash plus accounts receivable to total current liabilities; *Fixed Assets* is the ratio of plant, property, and equipment to total assets; *Market-to-Book* is the ratio of the market value of equity to the book value of equity; *Profitability* is the ratio of earnings before interest, taxes, depreciation, and amortization (EBITDA) to total assets, *Dividend Yield* is the ratio of dividend per share to price per share; *CapEx* is the ratio of capital expenditures to total assets; and *R&D* is the ratio of research and development expenditures to total sales. The data pertain to public firms excluding financials, limited partnerships and public utilities, that issued public equity or debt during the period January, 1980 through December 1998. The issuance incidences are from the SDC "New Issues" database and the accounting information is from the COMPUSTAT annual tapes.

Characteristics	Size	Quick Ratio	Fixed Assets	Market-to -Book	Censored M/B	Profit- -ability	Dividend Yield	CapEx	R & D
All Issuers (6448 Issues)									
Mean	6.266	1.744	0.357	17.826	5.546	0.114	0.0088	0.096	0.032
Std Dev	2.088	2.386	0.245	295.495	9.193	0.155	0.0145	0.100	0.072
Minimum	0.118	0.000	-0.287	0.000	0.000	-1.934	0.0000	0.000	0.000
25%ile	4.770	0.710	0.158	1.595	1.595	0.086	0.0000	0.035	0.000
Median	6.137	1.071	0.304	2.717	2.717	0.136	0.0000	0.067	0.000
75%ile	7.755	1.852	0.535	4.951	4.951	0.183	0.0141	0.117	0.035
Maximum	12.334	52.234	0.986	17514.880	50.000	0.915	0.1059	0.965	0.995
Short-Term Debt Issuers (1035 Issues)									
Mean	7.707	1.193	0.414	8.930	4.240	0.138	0.0145	0.093	0.014
Std Dev	1.912	2.191	0.239	67.160	7.408	0.088	0.0164	0.096	0.028
Minimum	0.202	0.000	-0.038	0.000	0.000	-0.639	0.0000	0.000	0.000
Median	7.895	0.849	0.373	2.279	2.279	0.136	0.0102	0.065	0.000
Maximum	12.334	34.307	0.986	1386.330	50.000	0.459	0.1026	0.781	0.227
Long-Term Debt Issuers (1762 Issues)									
Mean	7.684	1.053	0.457	6.989	3.726	0.141	0.0169	0.092	0.013
Std Dev	1.714	1.391	0.237	56.535	6.759	0.073	0.0172	0.077	0.026
Minimum	0.118	0.018	-0.287	0.000	0.000	-0.488	0.0000	0.000	0.000
Median	7.769	0.826	0.422	1.989	1.989	0.143	0.0141	0.075	0.000
Maximum	12.225	36.171	0.966	1471.130	50.000	0.710	0.1059	0.658	0.283
Equity Issuers (3651 Issues)									
Mean	5.173	2.234	0.293	25.577	6.794	0.094	0.0032	0.099	0.047
Std Dev	1.579	2.684	0.229	388.934	10.394	0.192	0.0089	0.111	0.090
Minimum	0.184	0.000	0.001	0.000	0.000	-1.934	0.0000	0.000	0.000
Median	5.166	1.426	0.226	3.338	3.338	0.130	0.0000	0.063	0.000
Maximum	10.837	52.234	0.966	17514.880	50.000	0.915	0.0916	0.965	0.995

Table 1B
Summary Statistics for Costs and Other Choice Characteristics

This table reports summary statistics of choice characteristics. *Firm-specific Cost* is the bond's yield to maturity for long- and short-term debt, in the case of that specific issue. When another security is issued, we use the Lehman Brothers bond index average for short-term and long-term debt respectively, (matched to the bond rating of the issue) for that month. The ratio of EBITDA to market value of equity is used for equity. *Market-Wide Cost* is equal to the average annual yield on 90-Day Treasury Bills in the month of the issue for short-term debt; the average annual yield on 10-year Treasury Notes in the month of the issue for long-term debt; and the average E/P ratio for companies in the SP500 index in the month of the issue for equity. The data pertain to public firms excluding financials, limited partnerships and public utilities, that issued public equity or debt during the period January, 1980 through December 1998. The issuance incidences are from the SDC database and the accounting information is from the COMPUSTAT annual tapes. *Marginal Pre-Financing Tax Rate* is provided by John Graham (see text), using interest expense from the year preceding the issue.

	Issuer-only Firm-Specific Costs (%)				**All Issuers Firm-Specific Costs (%)**			
	Short-Term Debt	Long-Term Debt	Equity	Censored Equity	Short-Term Debt	Long-Term Debt	Equity	Censored Equity
Mean	5.921	6.005	11.631	11.597	6.119	6.567	15.870	15.719
Std Dev	1.947	1.608	8.860	8.685	2.443	2.504	11.080	10.447
Minimum	2.120	3.513	0.131	0.131	1.907	3.111	0.131	0.131
25%ile	4.416	4.788	5.185	5.185	4.476	5.037	7.454	7.454
Median	5.682	5.836	9.304	9.304	5.712	6.175	13.820	13.820
75%ile	6.901	6.743	16.027	16.027	6.975	7.253	22.087	22.087
95%ile	9.526	8.629	28.349	28.349	10.115	10.198	34.869	34.869
99%ile	12.704	10.843	39.284	39.284	16.089	16.364	52.085	50.000
Maximum	15.131	32.998	66.188	50.000	32.772	41.123	84.943	50.000
	Pre-Tax Firm-Specific Costs (%)		**Term to Maturity (Yrs.)**		**Market-Wide Costs (%)**			
	Short-Term Debt	Long-Term Debt	Short-Term Debt	Long-Term Debt	Short-Term Debt	Long-Term Debt	Equity	
Mean	9.069	9.642	6.488	17.134	5.640	7.918	6.355	
Std Dev	2.810	2.646	2.612	8.604	2.094	2.027	2.451	
Minimum	3.235	5.405	0.500	10.000	2.670	4.750	3.043	
25%ile	6.861	7.523	5.005	10.022	4.500	6.460	4.388	
Median	8.788	9.048	7.003	12.030	5.210	7.360	5.590	
75%ile	10.607	11.450	8.122	23.357	6.060	8.620	7.547	
Maximum	28.020	33.219	9.997	63.495	17.488	15.030	14.368	
	Issue Proceeds ($M)				**Marginal Pre-Financing Tax Rate**			
	Short-Term Debt	Long-Term Debt	Equity	All Issues	Short-Term Debt	Long-Term Debt	Equity	
Mean	206.316	210.752	44.906	116.134	0.344	0.370	0.340	
Std Dev	356.779	279.001	95.881	231.307	0.090	0.077	0.133	
Minimum	3.000	3.800	0.750	0.750	0.000	0.000	0.000	
25%ile	79.800	99.200	10.400	17.750	0.340	0.340	0.340	
Median	124.200	147.800	22.575	50.000	0.350	0.350	0.349	
75%ile	206.200	244.800	46.875	125.000	0.370	0.460	0.390	
Maximum	5979.600	4473.600	2459.160	5979.600	0.460	0.460	0.510	

Table 1C
Correlations

This tables reports the correlation coefficients between costs and firm attributes. The data pertain to public firms excluding financials, limited partnerships and public utilities, that issued public equity or debt during the period: January, 1980 through December 1998. The issuance incidences are from SDC database and the accounting information is from the COMPUSTAT annual tapes.

	Issue-Specific Variables					**Firm-Specific Variables**							
	LT-Debt Firm Cost	Equity Firm Cost	ST-Debt Mkt. Cost	LT-Debt Mkt. Cost	Equity Mkt. Cost	Firm Size	Quick Ratio	Fixed Assets	Censored M/B	Profit-ability	Dividend Yield	Capital Exp.	R&D-to-Assets
ST-Debt Firm Cost	0.870	-0.030	0.348	0.346	0.315	-0.299	0.106	0.013	0.043	-0.336	-0.106	0.056	0.142
LT-Debt Firm Cost		-0.052	0.279	0.318	0.266	-0.294	0.121	0.011	0.046	-0.345	-0.113	0.050	0.140
Equity Firm Cost			0.150	0.203	0.213	0.284	-0.268	0.341	-0.302	0.330	0.464	0.034	-0.329
ST-Debt Mkt. Cost				0.858	0.876	-0.223	-0.033	0.036	-0.057	0.105	0.130	0.125	-0.022
LT-Debt Mkt. Cost					0.884	-0.244	-0.026	0.070	-0.109	0.095	0.190	0.116	-0.031
Equity Mkt. Cost						-0.210	-0.041	0.07 0	-0.092	0.113	0.210	0.138	-0.013
Firm Size							-0.181	0.237	-0.116	0.239	0.485	-0.047	-0.147
Quick Ratio								-0.219	0.123	-0.197	-0.195	-0.017	0.298
Fixed Assets									-0.150	0.188	0.221	0.549	-0.297
Censored M/B										-0.152	-0.210	0.000	0.145
Profit-ability											0.141	0.112	-0.458
Dividend Yield												-0.074	-0.142
Capital Exp.													-0.108

Table 2
Issues and Issuers

This table reports frequency of issues as well as the number of issues per year and by choice category. The data pertain to public firms excluding financials, limited partnerships and public utilities, that issued public equity or debt during the period January, 1980 through December 1998. The issuance incidences are from the SDC database and the accounting information is from the COMPUSTAT annual tapes.

By Number of Issuers

	Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18+
Frequency	3159	1831	695	262	136	68	41	27	35	12	9	6	9	7	5	2	1	6	7
Percentage	100	57.96	22	8.29	4.31	2.15	1.3	0.85	1.11	0.38	0.28	0.19	0.28	0.22	0.16	0.06	0.03	0.19	0.21

By Number of Issuers for Each Type of Financing

	Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18+
ST Debt	543	318	123	47	26	9	8	-	2	1	5	-	2	-	-	1	-	-	1
LT Debt	784	433	157	63	44	26	19	14	9	4	2	1	2	5	1	2	1	-	1
Equity	2517	1740	549	151	47	18	6	4	1	-	1	-	-	-	-	-	-	-	-

By Number of Each Type of Financing Per Year

	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98
All	252	201	215	443	138	261	327	231	138	193	158	414	405	548	308	503	586	612	515
ST Debt	15	16	28	11	19	30	38	44	35	34	40	61	80	87	59	69	113	125	131
LT Debt	63	35	52	63	58	83	137	59	48	51	43	98	113	155	57	142	123	183	199
Equity	174	150	135	369	61	148	152	128	55	108	75	255	212	306	192	292	350	304	185

By Percentage of Each Type of Financing Per Year

	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98
ST Debt	6.0	8.0	13.0	2.5	13.8	11.5	11.6	19.0	25.4	17.6	25.3	14.7	19.8	15.9	19.2	13.7	19.3	20.4	25.4
LT Debt	25.0	17.4	24.2	14.2	42.0	31.8	41.9	25.5	34.8	26.4	27.2	23.7	27.9	28.3	18.5	28.2	21.0	29.9	38.6
Equity	69.0	74.6	62.8	83.3	44.2	56.7	46.5	55.4	39.9	56.0	47.5	61.6	52.3	55.8	62.3	58.1	59.7	49.7	35.9

Table 3
Delta Posterior Summary

This table reports posterior distribution attributes of the 4×9 coefficient matrix $\boldsymbol{\Delta}$. In the hierarchical multinomial probit model, $\boldsymbol{\beta}_i$ is a 4−vector of parameters for firm i from the linear projection of the indirect utility derived from each choice on the characteristics of that choice. The population of firms is defined by the first stage of the prior: $\boldsymbol{\beta}_i = \boldsymbol{\Delta}\mathbf{Z}_i$. Where $\mathbf{Z}_i$ is the 9-dimensional vector of attributes for firm i. The interpretation of the $\boldsymbol{\beta}$ coefficients follows. β_1 is the intercept in the long-term debt utility equation. β_2 is the intercept in the equity utility equation. β_3 is the coefficient on firm-specific costs (restricted to be the same across equations). And β_4 is the coefficient on market-level costs (restricted to be the same across equations). For identification purposes, we have normalized the model so that the estimated utilities are differenced from the utility of short-term debt. The firm attributes have been differenced from the cross-sectional means. Thus, the "intercept" coefficients in the first column may be interpreted as the mean $\boldsymbol{\beta}$ coefficients across the sample.

Posterior	Intercept	Size	Quick Ratio	Fixed Assets	Market-to-Book	Profitability	Dividend Yield	CapEx	R & D
$\boldsymbol{\beta_1}$				**Long-Term Debt Intercept**					
Mean	**0.807**	**-0.103**	**0.125**	**0.640**	-0.00839	-0.142	**13.907**	**-1.883**	-1.224
Std Dev	0.143	0.044	0.058	0.381	0.00751	0.715	4.682	0.936	2.274
5%ile	0.573	-0.174	0.032	0.015	-0.02070	-1.316	6.301	-3.430	-4.891
25%ile	0.710	-0.132	0.086	0.384	-0.01346	-0.621	10.732	-2.512	-2.783
Median	0.805	-0.102	0.124	0.643	-0.00833	-0.148	13.845	-1.875	-1.259
75%ile	0.900	-0.074	0.164	0.894	-0.00332	0.343	17.039	-1.245	0.287
95%ile	1.042	-0.030	0.224	1.262	0.00409	1.021	21.735	-0.367	2.648
$\boldsymbol{\beta_2}$				**Equity Intercept**					
Mean	**3.398**	**-0.751**	**0.172**	**-1.969**	-0.00956	**2.982**	-11.073	**3.227**	**11.009**
Std Dev	0.191	0.065	0.059	0.487	0.00692	0.611	8.046	1.091	1.980
5%ile	3.091	-0.861	0.077	-2.784	-0.02111	1.987	-24.330	1.447	7.891
25%ile	3.262	-0.794	0.132	-2.284	-0.01425	2.569	-16.511	2.489	9.659
Median	3.390	-0.748	0.171	-1.962	-0.00951	2.979	-11.008	3.213	10.913
75%ile	3.527	-0.705	0.210	-1.644	-0.00485	3.382	-5.710	3.960	12.272
95%ile	3.726	-0.649	0.271	-1.176	0.00175	4.001	2.223	5.059	14.482
$\boldsymbol{\beta_3}$				**Coefficient on Firm-specific Cost**					
Mean	**-0.127**	**-0.019**	**-0.009**	**0.075**	-0.00069	**0.152**	0.395	-0.068	-0.282
Std Dev	0.014	0.005	0.005	0.040	0.00075	0.064	0.571	0.086	0.225
5%ile	-0.150	-0.028	-0.017	0.010	-0.00196	0.048	-0.552	-0.211	-0.657
25%ile	-0.137	-0.023	-0.012	0.048	-0.00119	0.108	0.016	-0.126	-0.435
Median	-0.128	-0.019	-0.009	0.075	-0.00067	0.152	0.404	-0.068	-0.276
75%ile	-0.118	-0.016	-0.006	0.102	-0.00018	0.195	0.778	-0.010	-0.125
95%ile	-0.104	-0.011	-0.001	0.141	0.00051	0.259	1.327	0.074	0.074
$\boldsymbol{\beta_4}$				**Coefficient on Market-Wide Cost**					
Mean	**-0.140**	0.024	**-0.053**	0.028	0.00425	0.193	**-3.639**	0.427	1.067
Std Dev	0.057	0.017	0.027	0.151	0.00347	0.312	1.846	0.389	0.895
5%ile	-0.235	-0.005	-0.100	-0.221	-0.00151	-0.320	-6.705	-0.205	-0.479
25%ile	-0.175	0.012	-0.071	-0.074	0.00177	-0.016	-4.881	0.163	0.509
Median	-0.138	0.024	-0.053	0.027	0.00428	0.191	-3.622	0.426	1.087
75%ile	-0.102	0.035	-0.035	0.129	0.00671	0.399	-2.408	0.687	1.657
95%ile	-0.047	0.053	-0.010	0.278	0.00986	0.719	-0.590	1.069	2.522

Table 4
Comparative Statics for Issue Choice Probability
Posterior Summary

Attributes of the posterior distributions of choice probabilities evaluated at mean values for all cost and firm attribute variables (base case). (Firm attribute data have been transformed to differences from the population means, so they are all 0 in the base case.) Comparative statics are obtained by perturbing the base case variables by adding (if the impact of the corresponding intercept on equity issuance was negative) or subtracting (if the impact of corresponding intercept on equity issuance was positive) one standard deviation, ceteris paribus. Probabilities here are obtained as follows: (1) Condition on the (Gibbs) draws of $\boldsymbol{\Delta}$ and $\boldsymbol{\Lambda}$, and the mean (or individually perturbed) firm attribute data. (2) This defines the expected value of $\boldsymbol{\beta}$ for this draw. (Note that we are integrating over $\mathbf{V}_{\boldsymbol{\beta}}$ to construct the draw of $E(\boldsymbol{\beta})$.) (3) This $E(\boldsymbol{\beta})$ coupled with the mean (or individually perturbed) cost data determines the expected indirect utility of each of the three alternatives. Since short-term debt is the numeraire choice, its indirect utility is deterministically 0.) (4) Probabilities are the result of the model assumption that (the random components of the) choices are drawn from a bivariate normal density, with mean $\mathbf{X}\boldsymbol{\beta}$ and variance-covariance matrix $\boldsymbol{\Lambda}$. (5) These choice probabilities are computed for each of the 30,000 Gibbs draws that comprise the model's marginal posterior (after an initial burn-in) in order to construct the marginal posterior choice probabilities.

	S-T Debt			**L-T Debt**			**Equity**		
Case	10%ile	Median	90%ile	10%ile	Median	90%ile	10%ile	Median	90%ile
Base	**14.1**	**17.1**	**20.4**	**30.6**	**35.0**	**39.4**	**41.9**	**47.8**	**53.7**
S-T Cost +	6.7	8.4	10.3	33.9	39.0	44.0	47.0	52.6	58.3
L-T Cost +	17.9	21.7	26.1	17.6	20.7	23.9	51.8	57.5	62.9
Eq. Cost +	30.3	34.2	38.0	58.4	62.4	66.4	1.4	3.1	5.9
Mkt. S-T +	8.4	12.1	16.6	32.4	37.2	41.9	44.2	50.5	56.7
Mkt. L-T +	15.9	19.4	23.2	21.5	27.7	34.2	45.6	52.8	59.7
Mkt. Eq. +	16.9	20.7	24.7	35.3	41.2	46.9	30.1	37.8	46.4
Size + (Total)	33.7	38.3	42.9	53.0	57.6	62.1	2.4	3.9	6.1
Direct Effect	33.4	38.3	43.4	47.7	53.1	58.4	5.5	8.4	12.2
QR + (Total)	9.7	13.7	18.1	24.5	31.0	37.4	46.7	55.3	63.5
Direct Effect	6.3	9.6	13.3	26.1	34.2	43.0	46.6	56.0	64.9
FA + (Total)	15.3	18.7	22.4	44.7	49.7	54.5	25.5	31.5	37.6
Direct Effect	17.0	20.9	25.4	46.3	52.8	59.0	19.6	25.9	33.2
M/B + (Total)	16.1	20.2	24.7	33.8	39.6	45.1	32.6	40.2	47.8
Direct Effect	16.0	20.1	24.7	27.8	34.1	40.4	38.2	45.6	53.3
Prof. + (Total)	4.4	6.3	8.8	12.4	16.1	20.4	71.7	77.4	82.6
Direct Effect	6.9	9.4	12.8	14.2	19.4	26.3	62.9	70.8	77.4
Yld. + (Total)	14.2	17.1	20.4	35.8	40.5	45.0	36.3	42.4	48.4
Direct Effect	13.6	16.7	20.3	39.2	44.9	50.4	31.2	38.2	45.4
CapEx + (Total)	10.7	14.2	18.5	19.4	24.4	29.8	53.4	61.1	68.6
Direct Effect	9.9	13.5	17.8	14.8	20.0	26.0	58.0	66.2	73.8
R&D + (Total)	4.3	7.9	13.4	12.2	19.8	28.8	59.4	71.8	82.3
Direct Effect	3.2	6.0	10.0	6.7	11.9	18.9	72.9	81.7	88.7

Table 5
Choice Probability Posterior Summary

Attributes of the posterior distributions of choice probabilities for 26 (randomly selected) firms. This table reports attributes of the marginal posterior distributions for the probability of choosing short-term debt, long-term debt, or equity, conditional on the firm attributes and the cost characteristics at the time of issue. **R.I.** signifies reduced information, where the estimation is conditioned only on the particular choice for that company (i.e., the other issues from that company in the sample were not used).

	Firm	Number	This	Year	**S-T Debt**			**L-T Debt**			**Equity**		
	Name	of Issues	Issue	of Issue	10%ile	Median	90%ile	10%ile	Median	90%ile	10%ile	Median	90%ile
1	Sippican	1	Equity	1983	0.0	0.0	0.2	0.0	0.0	0.4	99.2	100.0	100.0
2	Advanced Systems, Inc.	1	Equity	1983	0.0	0.0	2.1	0.0	0.0	2.7	94.0	100.0	100.0
3	Copley Pharamceut.	1	Equity	1993	0.0	0.0	2.1	0.0	0.0	1.6	94.7	100.0	100.0
4	ALC Communications	1	L-T Debt	1985	0.4	9.1	42.1	5.5	27.7	65.1	10.2	54.4	91.0
5	Dial Page Inc.	1	S-T Debt	1993	10.9	49.4	90.2	0.0	2.6	25.1	4.2	39.1	83.9
6	Zomax Optical Media Inc.	1	Equity	1998	0.0	0.0	2.1	0.0	0.1	4.7	91.8	99.9	100.0
7	Rent-A-Center	1	Equity	1986	0.0	0.0	1.1	0.0	0.0	0.6	97.2	100.0	100.0
8	Thermodynamics Inc.	1	Equity	1984	0.0	0.0	0.2	0.0	0.0	1.0	98.4	100.0	100.0
9	Robert Bruce Industries	1	L-T Debt	1985	2.1	20.3	58.2	22.1	62.6	91.3	0.0	1.3	54.8
10	Biotime	1	Equity	1994	0.0	0.0	2.1	0.0	0.1	4.7	91.8	99.9	100.0
11	Ames Department Store	2	Equity	1985	0.0	0.2	9.1	0.0	0.5	10.8	78.4	98.8	100.0
11	RI				0.2	7.4	43.3	0.8	12.0	45.4	25.7	72.3	97.5
12	New Era of Networks	3	Equity	1998	0.0	0.0	1.8	0.0	0.0	2.7	94.2	100.0	100.0
12	RI				0.0	2.2	32.8	0.0	4.2	35.2	36.4	89.8	99.9
13	ASK Group Inc.	3	Equity	1985	0.0	0.0	0.1	0.0	0.0	0.2	99.6	100.0	100.0
13	RI				0.0	4.9	38.3	0.1	6.7	39.4	31.0	82.3	99.6
14	Pier 1 Imports	3	S-T Debt	1994	25.9	52.9	78.6	16.5	40.8	68.4	0.0	0.5	18.2
14	RI				21.1	57.9	87.9	4.7	25.2	60.1	0.0	3.4	50.0
15	Bowater	4	L-T Debt	1991	1.0	10.4	36.5	59.3	87.1	98.3	0.0	0.0	7.1
15	RI				2.7	23.8	63.7	21.6	61.3	91.6	0.0	1.0	45.6
16	Nordstrom	5	S-T Debt	1990	42.1	66.2	85.5	11.5	28.9	52.1	0.0	1.1	14.2
16	RI				21.0	57.9	88.6	4.2	22.2	55.8	0.1	7.6	51.6
17	Borden	6	L-T Debt	1991	1.1	7.0	22.4	72.3	90.2	98.0	0.0	0.3	9.8
17	RI				4.0	25.5	62.2	18.8	52.3	84.5	0.0	7.8	55.8
18	Albertson's	6	L-T Debt	1996	11.3	27.9	51.0	20.2	39.8	61.9	10.2	27.6	52.4
18	RI				4.0	25.4	62.2	17.6	48.5	80.6	0.3	12.6	58.3
19	Pep Boys	6	S-T Debt	1998	43.4	73.0	92.6	3.1	14.9	36.7	0.7	7.6	29.9
19	RI				22.3	61.4	91.4	3.2	21.1	56.2	0.0	4.7	48.7

Table 5 (Cont'd.)
Choice Probability Posterior Summary

	Firm	Number	This	Year	**S-T Debt**			**L-T Debt**			**Equity**		
	Name	of Issues	Issue	of Issue	10%ile	Median	90%ile	10%ile	Median	90%ile	10%ile	Median	90%ile
20	Parker Hannafin	8	L-T Debt	1996	9.4	23.6	43.5	38.3	58.0	76.0	3.5	14.7	34.6
20	RI				4.4	26.2	62.4	19.2	53.5	85.2	0.0	5.8	53.6
21	TIG Holdings	9	L-T Debt	1991	15.6	31.9	52.2	47.1	67.5	84.0	0.0	0.0	1.0
21	RI				5.0	27.4	64.2	22.0	58.4	88.5	0.0	0.8	44.3
22	Pennzoil	10	L-T Debt	1987	2.7	9.9	24.0	52.8	73.7	88.3	2.6	12.8	35.0
22	RI				3.8	25.3	62.9	17.4	48.1	80.4	0.3	12.7	59.1
23	Mark IV Inds.	12	L-T Debt	1997	1.4	6.5	18.9	30.0	46.8	64.7	25.6	44.2	63.2
23	RI				3.9	25.3	62.8	20.1	55.7	87.3	0.0	4.3	52.1
24	Anheuser Busch	13	L-T Debt	1993	8.6	29.1	58.9	40.8	70.4	91.0	0.0	0.0	0.6
24	RI				2.2	22.2	63.7	18.7	55.5	88.8	0.0	6.5	55.0
25	McDonalds	17	L-T Debt	1997	12.5	24.1	38.9	60.2	75.1	86.8	0.0	0.0	2.1
25	RI				3.7	25.1	62.5	17.2	47.0	79.0	0.4	14.3	59.8
26	Dayton Hudson	25	L-T Debt	1992	1.8	8.8	25.1	74.6	91.2	98.2	0.0	0.0	0.0
26	RI				1.6	20.1	63.0	22.6	66.2	94.9	0.0	0.6	41.6

Table 6
The Value of the Information Contained in Firms' Other Choices

This table reports the averages of the marginal posterior distributions of the choice probabilities of firms' capital issuance choices for all firms with more than one issue in our sample. We report the results for two information sets. The full information set (FI) includes all of the issuing firm's issues in the conditioning information set, whereas estimation in case of the reduced information set (RI) treats each issue as though it is the only issue from that firm.

Issue	Information Set	Mean	Std. Dev.	5%ile	25%ile	Median	75%ile	95%ile
		925 Short-Term Debt Issues						
ST Debt	FI	0.4850	0.1782	0.1990	0.3526	0.4832	0.6158	0.7768
ST Debt	RI	0.5375	0.2774	0.0477	0.3228	0.5597	0.7697	0.9435
LT Debt	FI	0.3801	0.1662	0.1374	0.2537	0.3653	0.4928	0.6735
LT Debt	RI	0.2716	0.2133	0.0078	0.0926	0.2282	0.4129	0.6815
Equity	FI	0.1349	0.1169	0.0188	0.0544	0.1043	0.1843	0.3577
Equity	RI	0.1909	0.2290	0.0000	0.0066	0.0977	0.3133	0.6647
		1,552 Long-Term Debt Issues						
ST Debt	FI	0.2210	0.1405	0.0508	0.1143	0.1914	0.2998	0.4926
ST Debt	RI	0.2586	0.2374	0.0001	0.0494	0.1975	0.4172	0.7255
LT Debt	FI	0.6360	0.1676	0.3392	0.5236	0.6520	0.7631	0.8782
LT Debt	RI	0.5248	0.2440	0.1073	0.3429	0.5346	0.7164	0.9052
Equity	FI	0.1430	0.1153	0.0266	0.0657	0.1146	0.1905	0.3587
Equity	RI	0.2166	0.2364	0.0000	0.0173	0.1340	0.3581	0.6886
		2,140 Equity Issues						
ST Debt	FI	0.0547	0.0691	0.0061	0.0169	0.0340	0.0672	0.1752
ST Debt	RI	0.1437	0.1974	0.0000	0.0028	0.0514	0.2213	0.5717
LT Debt	FI	0.0940	0.0875	0.0165	0.0400	0.0706	0.1210	0.2536
LT Debt	RI	0.2029	0.1959	0.0001	0.0357	0.1504	0.3212	0.5873
Equity	FI	0.8513	0.1169	0.6405	0.8096	0.8788	0.9245	0.9639
Equity	RI	0.6534	0.2648	0.1709	0.4713	0.6894	0.8756	0.9928

Table 7
Variance Decompositions

This table reports the decomposition of the total explanatory power of our model that includes the prevailing market costs as exogenous variables in the issuance choice problem. The normalized model is contained in Equations (A.1) and (A.2). Here $\rho^2(U_e)$ and $\rho^2(U_l)$ represent the percentage of the total variance in the indirect utility from equity and long-term debt, respectively, that is explained by the model. (Short-term debt is the numeraire choice.) These are reported for the full model and three constrained versions of the model. In the Base Model, the choice-specific intercepts depend on firm attributes, the regressors are the firm-specific costs of each choice and the market-wide costs of each choice, and the sensitivities of indirect utilities to these costs depend on firm attributes. The Intercepts Only model has no choice-specific covariates. The intercepts are constrained to be constant across firms in the Costs Only model. The Intercepts and Market-Level Costs Only model excludes the firm-specific costs from the Base Model.

Element	Mean	Std. Dev.	5%ile	25%ile	Median	75%ile	95%ile
Base Model							
$\rho^2(U_l)$	0.54	0.03	0.49	0.52	0.54	0.56	0.58
$\rho^2(U_e)$	0.94	0.007	0.93	0.93	0.94	0.94	0.95
Intercepts Only (Firm Attributes)							
$\rho^2(U_l)$	0.32	0.03	0.27	0.30	0.32	0.34	0.37
$\rho^2(U_e)$	0.79	0.02	0.76	0.78	0.79	0.80	0.81
Costs Only							
$\rho^2(U_l)$	0.45	0.02	0.42	0.44	0.45	0.46	0.48
$\rho^2(U_e)$	0.87	0.01	0.85	0.86	0.87	0.87	0.88
Intercepts and Market-level Costs Only							
$\rho^2(U_l)$	0.47	0.03	0.42	0.45	0.47	0.49	0.51
$\rho^2(U_e)$	0.82	0.02	0.79	0.81	0.82	0.83	0.84

Table 8
Variance-Covariance Matrix and
Observed Heterogeneity Posterior Summary

This table reports properties of the marginal posterior distributions of the two variance-covariance matrices in the hierarchical random choice model as well as summary measures of the observed heterogeneity of utilities and $\boldsymbol{\beta}$. The Random Utility Variance-Covariance matrix is $\boldsymbol{\Lambda}$. The Variance-Covariance Matrix of $\boldsymbol{\beta}$ is $\mathbf{V}_{\boldsymbol{\beta}}$. Explained heterogeneity of the $\boldsymbol{\beta}$ coefficients is measured by $\rho^2(\beta_j) = 1 - \frac{V_{\beta_{j,j}}}{\sigma^2(\beta_j)}$.

Panel A. Random Utility Variance-Covariance Matrix ($\boldsymbol{\Lambda}$)

Element	Mean	Std. Dev.	5%ile	25%ile	Median	75%ile	95%ile
(1,1)	1.00	0.00	1.00	1.00	1.00	1.00	1.00
(1,2)	0.49	0.02	0.46	0.48	0.49	0.51	0.53
(2,2)	1.02	0.04	0.94	0.98	1.01	1.04	1.09

Panel B. Variance-Covariance Matrix of $\boldsymbol{\beta}$

Element	Mean	Std. Dev.	5%ile	25%ile	Median	75%ile	95%ile
(1,1)	1.29	0.24	0.92	1.11	1.27	1.44	1.71
(1,2)	0.86	0.24	0.48	0.70	0.86	1.01	1.28
(1,3)	-0.03	0.02	-0.05	-0.04	-0.03	-0.02	0.00
(1,4)	-0.29	0.07	-0.42	-0.33	-0.28	-0.23	-0.17
(2,2)	3.35	0.60	2.46	2.93	3.26	3.73	4.44
(2,3)	-0.16	0.03	-0.22	-0.18	-0.16	-0.14	-0.11
(2,4)	-0.04	0.09	-0.18	-0.10	-0.04	0.02	0.11
(3,3)	0.03	0.003	0.02	0.02	0.03	0.03	0.03
(3,4)	0.003	0.006	-0.007	0.00	0.00	0.01	0.01
(4,4)	0.14	0.03	0.10	0.12	0.14	0.16	0.19

Panel C. Explained Heterogeneity of $\boldsymbol{\beta}$

Element	Mean	Std. Dev.	5%ile	25%ile	Median	75%ile	95%ile
$\rho^2(\beta_1)$	0.14	0.06	0.05	0.10	0.13	0.18	0.24
$\rho^2(\beta_2)$	0.51	0.04	0.45	0.49	0.51	0.54	0.57
$\rho^2(\beta_3)$	0.11	0.05	0.03	0.08	0.11	0.15	0.21
$\rho^2(\beta_4)$	0.20	0.08	0.07	0.14	0.19	0.25	0.34

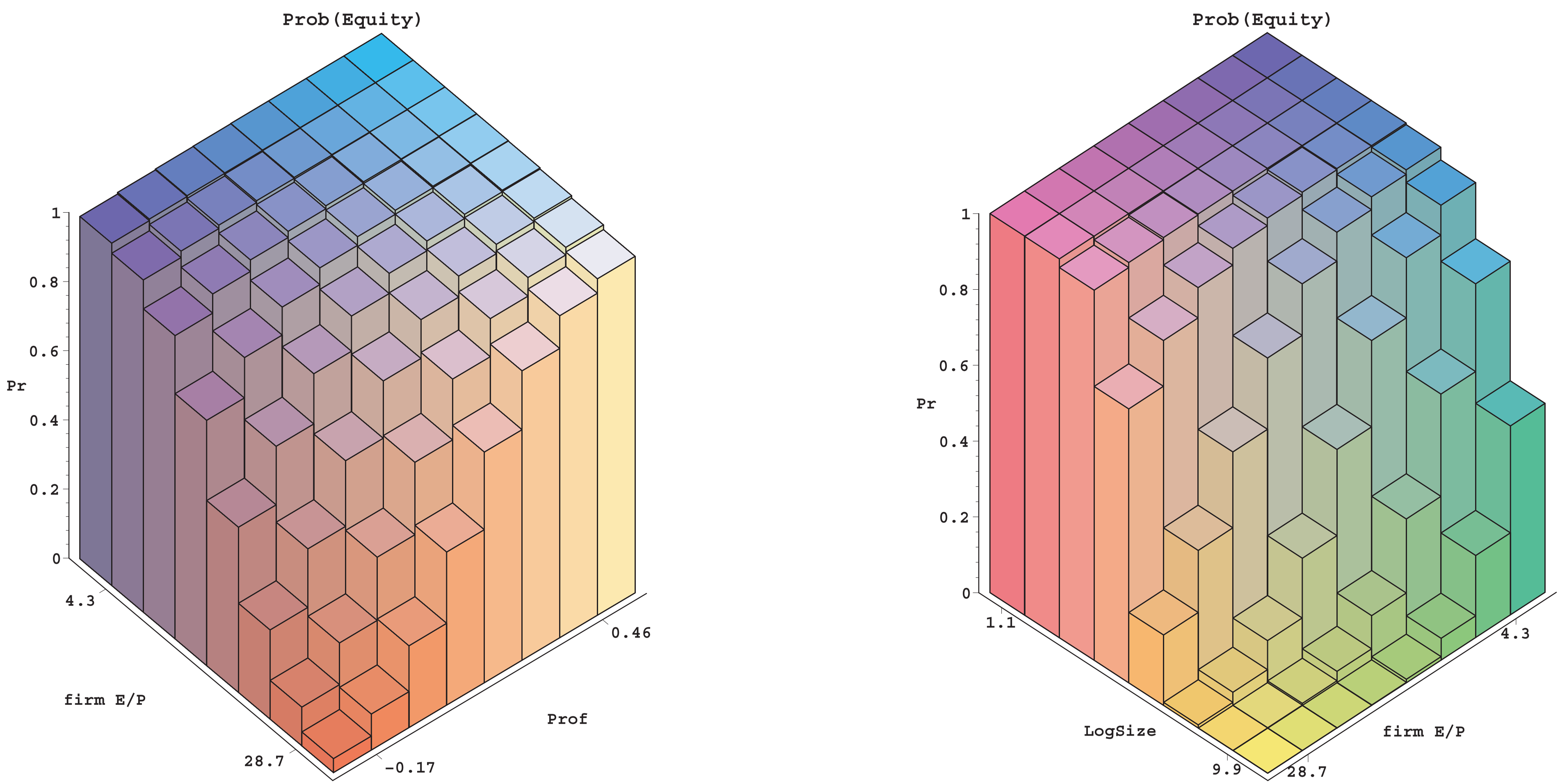

Figure 1: **The Probability of Equity Issuance.** The left panel shows the effect of profitability (i.e., EBITDA/TA) and the firm's equity capitalization rate (i.e., the earnings yield on the firm's stock) on its probability of issuing equity. The right panel shows the effect of the firm's log-size and equity capitalization rate on its probability of issuing equity.

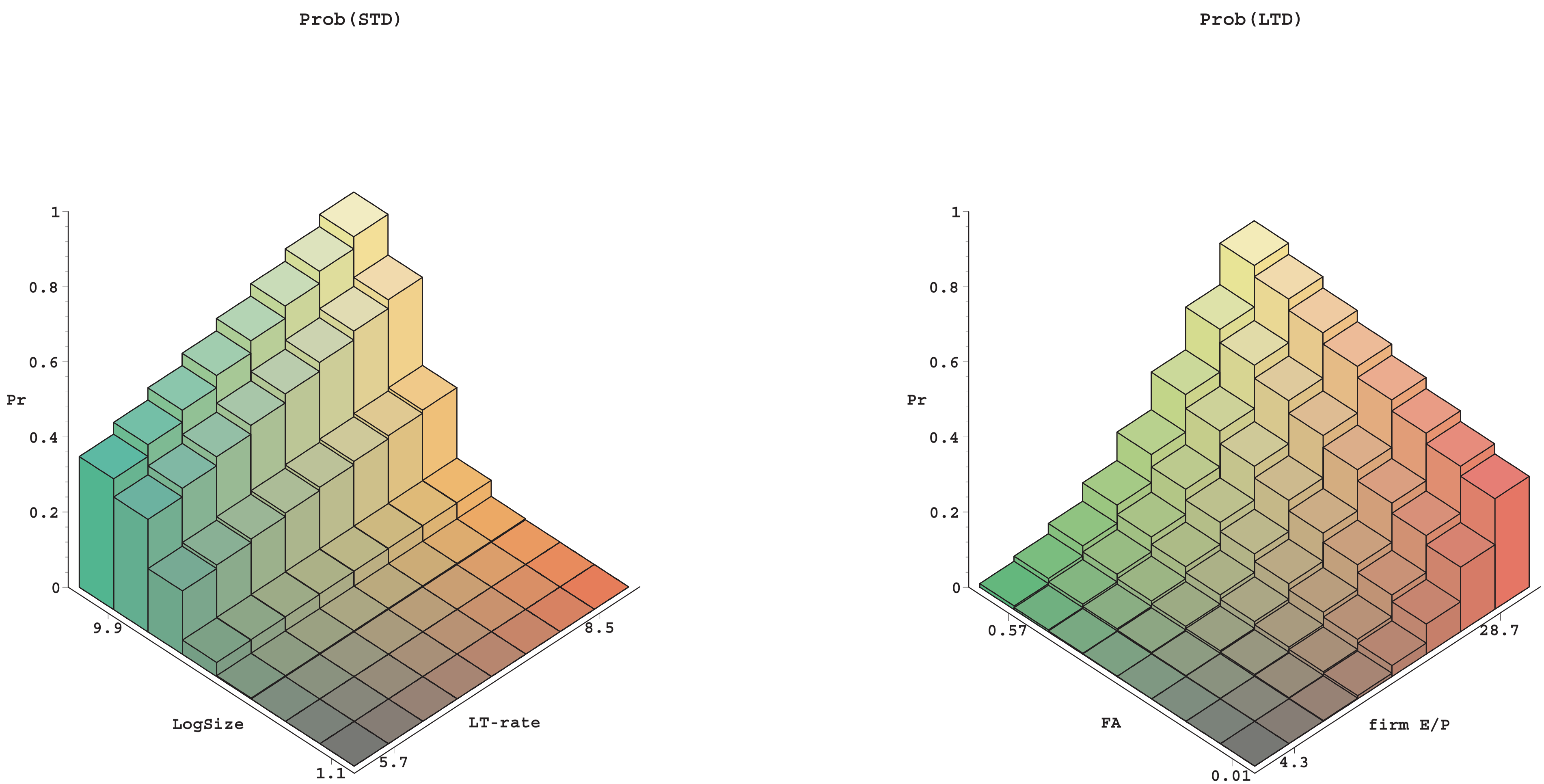

Figure 2: **Issuance Probabilities.** The left panel shows the effect of both the firm's log-size (i.e., log(market value of equity plus book value of debt)) and its after-tax long-term debt yield on the probability of issuing short-term debt. The right panel shows the effects of a firm's tangibility (i.e., property, plant, and equipment, divided by total assets), and its equity capitalization rate on its probability of long-term debt issuance.

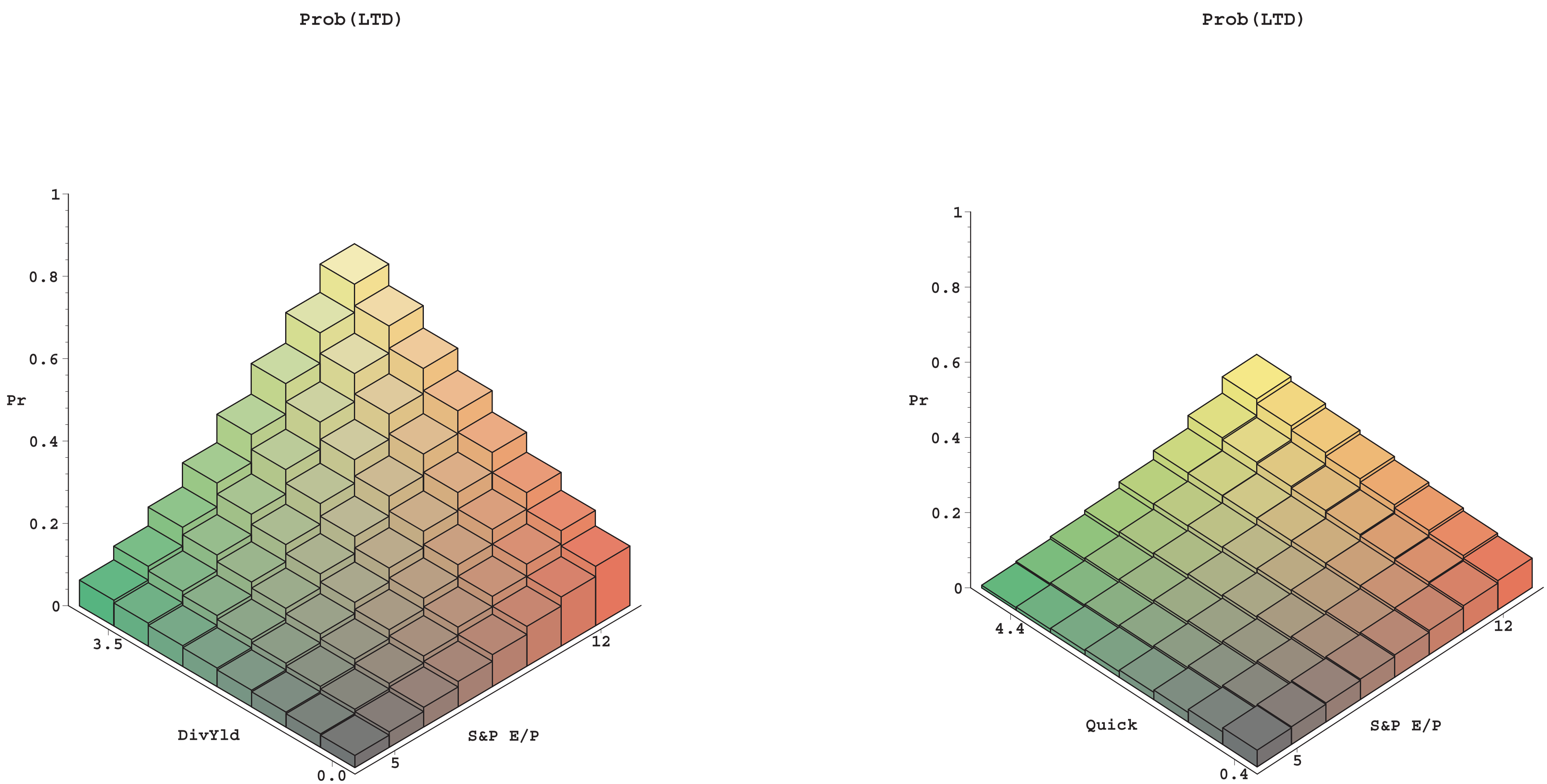

Figure 3: **Market-wide Conditions and Long-Term Debt Issuance Probabilities.** The left panel shows the effect of both the firm's dividend yield and the earnings-price ratio on the S&P 500 on the probability of issuing long-term debt. The right panel shows the effect of both the firm's quick ratio (i.e., cash plus accounts receivable, divided by current liabilities) and the earnings-price ratio on the S&P 500 on the probability of issuing long-term debt.