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Firm Size and Dividend Payouts

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This paper presents a model of large institutional and small individual investors choosing stocks. Dividend policy of firms is determined by the preferences of the resulting stockholders. Large investors choose to invest in large corporations because it lowers their transaction costs. Since these institutions prefer dividends, the large corporations choose to pay dividends, while the small corporations, owned by individuals, do not. The results show that firm size and liquidity explain the decision of *whether* to pay dividends well, whereas existing informational explanations (such as monitoring and signaling) explain the *level* of dividends well. *Journal of Economic Literature* Classification Numbers: G32, G35, G11. © 1997 Academic Press

1. INTRODUCTION

The idea that firm size and dividend payout are positively correlated is generally accepted by many financial economists. However, this relationship has received surprisingly little direct attention in the literature. This paper investigates this correlation from a theoretical and empirical perspective. To address this relationship, a model is developed in which investors divide into clienteles based on their demands for liquidity. In the resulting equilibrium, the dividend preferences of investors are correlated with the size of the companies in which they choose to invest. In this model, the choice of dividend policy is made by managers who, in order to minimize the cost of equity capital, enact dividend policies in accordance with their investors' wishes. The empirical implications of the model are then tested and verified. The findings are that firm size and market liquidity are important determinants in a company's decision whether to pay dividends. However, existing

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informational explanations of dividends retain strong importance for the question of the level of dividends paid.

There are two types of investors in the model, individuals and institutions. Although alike in most respects, such as risk aversion and investment horizon, these types of investors have two important differences. First, a given individual investor is likely to own fewer shares than a given institutional investor. Second, while individual investors are not likely to prefer dividends due to the associated tax penalties, institutional investors often do prefer dividends, both for tax and for fiduciary reasons.

Profit-maximizing investors consider not only the gross return from investing in various types of securities, but also the transactions costs involved. In my model, transactions costs arise from imperfect market depth. In an environment of finite depth, an investor's decision to buy an asset pushes up the market price from what would otherwise obtain. This adverse effect will be shown to be more important to large investors. Since market depth will be shown to be greater for large companies than for small companies, an investor's portfolio allocation decision between large and small company stocks will depend on the scale of his investments. In the equilibrium I derive, the small dividend-averse investors choose to purchase small company stocks. Large companies, however, are purchased by large dividend-loving investors who are attracted by the superior market depth. Large companies are therefore more likely than small companies to pay dividends.

This paper is related to several strands of the theoretical and empirical literature on dividends. On the empirical side, Elton and Gruber (1970) present support that investors divide into clienteles according to their tax bracket, with high bracket investors buying low dividend payout stocks. Badrinath *et al.* (1989) show that institutional investors tend to hold dividend paying stocks. These results support a premise of this paper that tax incentives affect the dividend demand of a given investor. Amihud and Mendelson (1986, 1991) show theoretically that liquidity should be relevant for short-term investors, and verify empirically that this liquidity value is priced into expected returns. The premise that the market for stocks is characterized by limited depth also has support in the literature. Harris and Gurel (1986) find that stocks experience abnormal returns upon entering the S&P 500 index, since inclusion in the index causes an increase in demand from portfolio managers seeking to mimic the performance of the popular index. Also, Loderer *et al.* (1991), by looking at the non-informational effects of secondary stock issues, verify the relevance of limited market depth in the face of supply or demand shocks. Finally, empirical findings by Jensen *et al.* (1992) that institutional investors tend to hold large corporations support the premise of this paper that market depth is relevant to large investors.

There have been previous theoretical contributions addressing the interactions of institutional investors and individual investors. Auerbach and King (1982) derive a complex equilibrium from hypothesized differences in risk aversion between the two types of agents. Similarly, Feldstein and Green (1983) model a diversification argument under which individuals choose to hold some dividend-paying stocks despite a tax disadvantage. My paper differs from these in that it does not rely on these hypothesized risk aversion or limited diversification opportunity arguments to explain the differing behavior of investors.

Combining firm life-cycle models with tax-capitalization ideas also suggests results similar to those found in this paper. In life-cycle models such as those of Stiglitz (1973) and Sinn (1991), firms distribute assets upon reaching an efficient size. This suggests why large firms may be more likely to pay dividends. However, this only applies if, as assumed in tax-capitalization models such as that of Auerbach (1979), dividends are the only way to distribute assets. My results, however, are robust to the possibility of tax-preferred open market repurchases, as institutions (perhaps strictly) prefer dividends to repurchases, even while individuals may strictly prefer repurchases to dividends. Other theoretical contributions to the question of why repurchases do not dominate dividends include Brennan and Thakor (1990) and Barclay and Smith (1988), which suggest that open-market repurchases offer opportunities for informed parties to gain at the expense of uninformed shareholders.

The remainder of this paper is organized as follows. Section 2 presents an overview of the model in this paper. Section 3 derives the supply of corporate shares by insiders seeking to sell equity in their companies to alleviate the risk in holding those shares and the demand for shares by investors of different types. Section 4 shows the existence of an equilibrium and derives the implications of the resulting equilibrium for the cross section of corporate dividend policy. The empirical implications are tested in Section 5, and Section 6 concludes.

2. MODEL OUTLINE

2.1. *Companies*

This paper presents a model in which agents trade shares in companies. These shares entitle the owner to share in the liquidation value of a firm. No short sales of the shares are allowed. There are two types of firms, big and small. There are F^{b} big firms and F^{s} small firms. For each company, a share has been normalized to be a claim with an expected liquidation value of one dollar. Therefore, the number ψ^{b} of shares in each large firm will be greater than the number ψ^{s} of shares in each small firm.

Each company will also be affected by an independent stochastic shock which will cause the realized liquidation value to be $1 + \varepsilon_i$ per share. ε_i is normally distributed with zero mean and variance σ_ε^2. The value of σ_ε^2 is common across companies of both sizes, and the realizations of ε_i are independent across companies.

Some companies are "dividend-paying" and some are not "dividend-paying." Although some investors will prefer stocks which are "dividend-paying" and some investors will not, the dividend status of a company has no effect on its gross liquidation value and can be costlessly chosen by the company's owners.

These companies are owned by corporate insiders or entrepreneurs. Each large company has R^{b} entrepreneurs, and each small company has R^{s} entrepreneurs, where $R^{\mathrm{b}} > R^s$. Ownership in the company is split evenly between the entrepreneurs of that company. Entrepreneurs are indifferent to the dividend payout of their portfolios, but are risk averse with a common coefficient γ of absolute risk aversion. An entrepreneur would therefore be willing to sell some of her risky shares for cash at a price below the expected liquidation value of unity.

2.2. *Investors*

There are also ρK risk-neutral outside investors, where $\rho > 1$ and $K > 1$. These investors will purchase stock if doing so creates a positive expected return and will purchase the type of stock with the greatest expected return. These investors are heterogeneous with respect to their cash endowments. There are ρ investors with endowments of I_i dollars for each $i = 1, \ldots, K$, where $I_i < I_{i+1}$. Each investor can hold an arbitrary number of stocks in his portfolio, but faces convex monitoring costs based on the number of firms in his portfolio. It is not important for the qualitative results of this model that these costs, or their convexity, be large in magnitude. As a result of these convex costs, large investors, who will be shown to hold a larger number of stocks, face a higher marginal cost of adding firms to a portfolio. Therefore, large investors will have a larger dollar amount invested in each firm in their portfolios than small investors will. This assumption, that large institutions hold large amounts of individual securities, has been documented in the literature. For example, Cummins and Westerfield (1981) examine pension funds and find that despite federal ERISA provisions requiring that pension plans hold diversified portfolios, the median pension fund's equity portfolio has over 40% of its value represented by the 10 largest holdings.

Some investors, who can be considered institutional investors, wish to own stocks which are dividend-paying. Other investors, which can be considered individual investors, wish to own stocks which are not dividend-paying.

The fraction of investors of a given size I who prefer dividend-paying stocks is given by the function $D(I)$. Since the institutional investors who are more likely to prefer dividends are also likely to be larger than individual investors, this function $D(I)$ is increasing in I.

2.3. *Timing*

The timing of this model is as follows:

1. Firms choose dividend policy.
2. All outside investors simultaneously place market orders for the stocks they wish to hold in their portfolios.
3. In each company, the entrepreneurs compete to fill the market orders. This results in a price for each company's stock.
4. The shares are then traded for later settlement.
5. The stochastic component of each company's liquidation value is realized.
6. Trades settle. All companies are liquidated and the proceeds are paid to shareholders.
7. Consumption takes place.

2.4. *Markets*

Notice that investors must place market orders both before the realization of the market price and realization of the liquidation price, but settlement takes place after the realization of these prices. It is assumed that there is a margin requirement that investors placing an order to purchase stock must demonstrate cash resources to pay for these shares upon settlement. This margin requirement will be assumed to be one dollar per share of stock, which is equal to the expected liquidation value of any share and therefore equal to the maximum expected price any investor would pay for a share of stock. This has two implications. First, an investor with $\$I$ to invest will purchase I shares of stock (the maximum possible) as long as the price is low enough to generate non-negative expected profits. Second, since the entrepreneurs are endowed only with shares, and the market price of these shares is not guaranteed to be above any positive minimum value, the entrepreneurs are unable to purchase shares in other companies at all. Trade therefore consists of entrepreneurs selling shares to investors, and thereby redistributing some of the idiosyncratic risk of their company's liquidation value among the many investors.

The impact an investor's trades have on the resulting market price will be an important consideration to an investor. Stocks which have heavy demand will have a higher price. Investors place their market orders simultaneously and without collusion. Since all companies of a given type (e.g., all dividend-paying large companies) are identical, each investor is effectively choosing companies to invest in randomly from the set of the companies of the preferred type. From the perspective of a given investor, therefore, the expected demand excluding his own demand, and therefore the expected price that would obtain, of a given stock will be equal for all companies of a given size. If this were not the case, more investors would switch to the identical company with the lower expected price. However, adding in the orders of that investor means increasing the total demand for the stocks he chooses to buy. Since markets have finite depth, this will push up the price of the stock from what would otherwise obtain. This transaction cost will be higher for investors of larger sizes and for investors in less liquid stocks. An investor choosing companies to invest in will therefore consider not only the factor of higher gross expected return (before considering these liquidity costs) but also these transaction costs related to market depth. Since these transaction costs vary by the size of investor, this will result in investors of different sizes having demands for different types of shares.

The interactions of the investors' demand for shares and the entrepreneurs' supply of shares will yield equilibrium portfolios for investors. To minimize the cost of equity capital, the fraction of managers choosing to pay dividends will be equal to the fraction of investors who wish to collect dividends. The cross section of dividend policies can therefore be found from the dividend preferences of the population of shareholders in each type of company. This generates results for the correlation between company size and dividend payout decisions.

3. SUPPLY AND DEMAND FOR SHARES

3.1. *Supply of Shares*

This section presents a stylized model of the supply in shares in the F^{b} large firms and F^{s} small firms. The entrepreneurs who own each company are interested in selling shares in their company to alleviate the idiosyncratic risk in those shares. The source of this elastic supply is not important. Rather than entrepreneurs, it could be other selling shareholders or market makers (such as in Grossman and Miller (1988)) seeking to unload their inventory.

All entrepreneurs are risk-averse and are assumed to have the same constant coefficient γ of absolute risk aversion. It is well known that agents with constant absolute risk aversion and normally distributed wealth act as if to maximize

$$\mu_W - \frac{\gamma}{2}\sigma_W^2, \tag{1}$$

where μ_W is the expected value of wealth and σ_W^2 is the variance of wealth. An entrepreneur will therefore decide how many shares to hold in order to maximize (1). An entrepreneur in company i of type j holding S_i^j shares in the company and selling the remaining shares of her endowment at a price P_i^j will have expected wealth given by

$$\mu_W = S_i^j + \left(\frac{\psi^j}{R^j} - S_i^j\right) P_i^j. \tag{2}$$

The variance of wealth resulting from the noisy liquidation value will depend on the number of shares held:

$$\sigma_W^2 = (S_i^j)^2\sigma_\varepsilon^2. \tag{3}$$

An entrepreneur of company i will therefore choose the number of shares held to solve

$$\max_{S_i^j}\left[S_i^j + \left(\frac{\psi^j}{R^j} - S_i^j\right) P_i^j - \frac{\gamma}{2}(S_i^j)^2\sigma_\varepsilon^2\right]. \tag{4}$$

This maximization problem has the first-order condition

$$1 - P_i^j - \gamma S_i^j \sigma_\varepsilon^2 = 0 \tag{5}$$

and therefore a solution (the second-order condition is easily verified) in terms of the number of shares held of

$$S_i^j = \frac{1 - P_i^j}{\gamma\sigma_\varepsilon^2}. \tag{6}$$

This means that the number of shares supplied is given by $\psi^j/R^j - S_i^j$, or

$$\frac{\psi^j}{R^j} - \frac{1 - P_i^j}{\gamma\sigma_\varepsilon^2}. \tag{7}$$

If the number of shares demanded by investors through (inelastic) market orders is η_i^j, then the price will be set to induce each of the R^j identical entrepreneurs to supply η_i^j/R^j shares:

$$\frac{\eta_i^j}{R^j} = \frac{\psi^j}{R^j} - \frac{1 - P_i^j}{\gamma\sigma_\varepsilon^2}. \tag{8}$$

This can be easily solved for price

$$P_i^j = 1 + \frac{\eta_i^j - \psi^j}{R^j}\gamma\sigma_\varepsilon^2. \tag{9}$$

Investors concerned about market depth are concerned about the fact that by adding to the demand for the stock, the investor is increasing the price of the shares he wishes to buy. Equation (9) shows that the response of the price of the company's stock to an increase in investor demand for its shares is given by

$$\frac{dP_i^j}{d\eta_i^j} = \frac{\gamma\sigma_\varepsilon^2}{R^j}. \tag{10}$$

Equivalently, this could be represented in terms of market depth. Market depth, denoted here by φ^j, is defined as the size of extra demand required to push up the market price by one dollar. It is therefore the reciprocal of the value in Eq. (10), and is given by

$$\varphi^j = \frac{R^j}{\gamma\sigma_\varepsilon^2}. \tag{11}$$

Since $R^{\mathrm{b}} > R^{\mathrm{s}}$, Eq. (11) implies that large firms have a greater depth, or $\varphi^{\mathrm{b}} > \varphi^{\mathrm{s}}$. This means that large firms are more liquid than small firms, and therefore have lower transaction costs associated with them. As will be seen in the next section, these transaction costs are more important to large investors than to small investors. The result given will therefore imply that large investors have a greater incentive than small investors to invest in large-company stocks.

3.2. *Demand for Shares*

Having determined via Eqs. (9) and (11) the market environment facing investors purchasing shares, attention can now be turned to the topic of investors' demand for shares. The risk-neutral investors are distinguished by their size and their dividend preference. Investors are endowed with only cash, and are not allowed to sell shares short. Therefore, the only market activity permitted to these investors is placing market orders to buy shares. The size of an investor is given by the amount of his cash endowment, denoted by $\$I$. Due to the margin requirements listed above, such an investor can purchase a maximum of I shares of stock. Some investors prefer dividends (for tax, fiduciary, or other reasons), while others prefer to own stocks that do not pay cash dividends. The fraction of investors of each size who do prefer cash dividends, represented by the function $D(I)$, is taken to be increasing in I. Investors are also subject to a monitoring cost $M(N)$ which is convex and increasing in the number N of companies held in the portfolio. For simplicity $M(N)$ will be taken to be proportional to the square of N:

$$M(N) = cN^2. \tag{12}$$

An investor faces three portfolio decisions: whether to choose dividend-paying stocks or non-dividend-paying stocks, whether to buy stock in large companies or small companies (or both), and how many companies to split the portfolio between. By assumption, there are sufficient dividend and non-dividend paying stocks of both sizes so that the total number of firms of any sort is not a binding constraint on any investor constructing a portfolio.

Entrepreneurs can costlessly shift between paying and not paying dividends. Therefore, in order to minimize the cost of equity capital, the fraction of entrepreneurs in large companies (and small companies) choosing to pay dividends will exactly equal the fraction of investors (weighted by size) in large companies (and small companies) who prefer to collect dividends. This means that large-company stocks (or small-company stocks) will be priced the same whether they pay dividends or do not. Therefore, an institutional investor will choose dividend paying stocks, and an individual investor will choose stocks which do not pay dividends. In other words, dividend paying stocks of both sizes serve institutional clienteles, while non-dividend paying stocks of both sizes serve individual clienteles.

The relationship between the size of an investor, as parameterized by his cash endowment I, and the choice of portfolio is more complex. An investor will choose to invest in the size of company which is expected to be more profitable to that investor. This decision will depend on the transaction costs resulting from the imperfectly liquid markets and the difference in expected returns (gross of these liquidity costs) on the two sizes of company shares.

Since the analysis of the last section, and particularly Eq. (9), shows that the market price for a stock will be higher if there are more buy orders for it, any investor would like to purchase stocks for which there are few buy orders placed. Since all investors submit market orders simultaneously and without collusion, the exact number of buy orders in any given company is not known. However, a risk-neutral investor will care only about the expected number of buy orders, since Eq. (9) shows that this is a sufficient statistic for the expected price and therefore the expected profits. Since all companies are identical, the expected number of market orders *excluding that investor's trades* are equal for each company of a given size. The trades of that investor will therefore push up the price from what would otherwise obtain. Further, this effect on price will be greater in magnitude for less liquid shares and for larger sized orders.

Liquidity-related transaction costs therefore depend on the number of shares purchased and the depth of the company. An investor purchasing I total shares in N companies will invest in I/N shares in each company. This implicit strategy of splitting the portfolio evenly is optimal in the current environment of imperfect market depth. Uneven portfolio weights would mean being heavily weighted in those issues with the worst expected transaction costs. Using P_o to denote the expected market price that would prevail without considering the trades of the investor being focused on, the effect of adding I/N shares of demand will be to increase the transaction price to

$$P_o + \frac{I}{N\varphi}. \tag{13}$$

The gross return from investing a portfolio of size I in shares of type j is therefore the appreciation of a share multiplied by the number of shares held. Since the expected liquidation value of a share has been normalized to 1, the expected return on the shares net of the monitoring cost is given by

$$\pi^j = I\left(1 - P_o^j - \frac{I}{N^j\varphi^j}\right) - c(N^j)^2. \tag{14}$$

To determine which sort of company is more profitable to invest in, it must be determined whether the value of (14) is greater for large firms or small firms. To do this, it is necessary to find the optimal number N^j of companies into which a given investor in shares of type j would choose to split his investment. The first-order condition of maximizing (14) with respect to N^j is

$$\frac{I^2}{\varphi^j(N^j)^2} - 2cN^j = 0 \tag{15}$$

which can be easily solved (the second-order condition is easily verified) for N^j:

$$N^j = \sqrt[3]{\frac{I^2}{2c\varphi^j}}. \tag{16}$$

Equation (16) specifies the optimal number of companies for an investor of size I to invest in. Inserting this optimal value of N^j into Eq. (14) gives the expected return π^j to an optimizing investor in shares of type j:

$$\pi^j = (1 - P_{\mathrm{o}}^j)I - 3I\sqrt[3]{\frac{Ic}{4(\varphi^j)^2}}. \tag{17}$$

Since investors are risk neutral, an investor will choose to invest in large companies if and only if this offers a greater net expected return. That is, an investor will invest in large-company stocks if and only if the liquidity advantages of large-company stocks exceed the gross expected return advantage of small-company stocks. Using Eq. (17) for large and for small companies shows that this condition is given by

$$(1 - P_{\mathrm{o}}^b)I - 3I\sqrt[3]{\frac{Ic}{4(\varphi^{\mathrm{b}})^2}} \geq (1 - P_{\mathrm{o}}^{\mathrm{s}})I - 3I\sqrt[3]{\frac{Ic}{4(\varphi^{\mathrm{s}})^2}}. \tag{18}$$

This can be rewritten as

$$3I\left[\sqrt[3]{\frac{Ic}{4(\varphi^{\mathrm{s}})^2}} - \sqrt[3]{\frac{Ic}{4(\varphi^{\mathrm{b}})^2}}\right] \geq (P_{\mathrm{o}}^{\mathrm{b}} - P_{\mathrm{o}}^{\mathrm{s}})I, \tag{19}$$

where the left-hand side of (19) represents the liquidity advantages of investing in large-company stocks and the right-hand side represents the higher expected returns (gross of liquidity costs) of investing in small-company stocks. Straightforward algebraic manipulation enables this equation to be rewritten as

$$I \geq \frac{4(\varphi^{\mathrm{s}}\varphi^{\mathrm{b}})^2(P_{\mathrm{o}}^{\mathrm{b}} - P_{\mathrm{o}}^{\mathrm{s}})^3}{27c((\varphi^{\mathrm{b}})^{2/3} - (\varphi^{\mathrm{s}})^{2/3})^3}. \tag{20}$$

This is the key result of this section. Liquidity concerns are especially great for larger traders, whose trades have a larger adverse effect on transaction prices. For a given small-firm premium (price discount) given by $(P_{\mathrm{o}}^{\mathrm{b}} - P_{\mathrm{o}}^{\mathrm{s}})$, then traders above a certain size will buy the large-company stocks and traders below that size will buy the small-company stocks. For these small investors, then, the small-firm premium outweighs the associated liquidity concerns.

Having analyzed supply of shares in the previous section and demand for shares in this section, the next section turns to the consideration of the equilibrium and the resulting implications for the cross section of dividend payout.

4. EQUILIBRIUM

4.1. *Existence*

An equilibrium exists if the actual average market price of each type of stock equals the expected average market price of each type of stock and the total number of shares supplied by entrepreneurs in each company equals the total number of shares demanded. On the other hand, since market orders on the company level are placed simultaneously and without coordination, there is no guarantee that the expected market price of each individual company's stock equals the actual market price. The total number of shares demanded, and thus the market price, is known only in expectation for each individual company. However, the total number of shares demanded of any given type is known. Therefore, the average number of shares demanded, and the average market price, can be determined.

Multiplying Eq. (8) through by the number of entrepreneurs R^j gives the shares supplied in company i of type j for any given price:

$$s_i^j = \psi^j - \frac{R^j}{\gamma\sigma_\varepsilon^2}(1 - P_i^j). \tag{21}$$

Since there are F^{s} small companies, then, the total supply of small-company shares will be given by

$$S^{\mathrm{s}} = F^{\mathrm{s}}\left(\psi^{\mathrm{s}} - \frac{R^{\mathrm{s}}}{\gamma\sigma_\varepsilon^2}(1 - P^{\mathrm{s}})\right), \tag{22}$$

where P^{s} is the average market price of small-company shares. Since there are F^{b} big companies, the total supply of big company shares will be given by

$$S^{\mathrm{b}} = F^{\mathrm{b}}\left(\psi^{\mathrm{b}} - \frac{R^{\mathrm{b}}}{\gamma\sigma_\varepsilon^2}(1 - P^{\mathrm{b}})\right), \tag{23}$$

where P^{b} is the average market price of large-company shares. Naturally, the supply of either type of share is increasing in its price.

The total number of shares demanded by investors (as long as stocks offer a positive return) is given inelastically by

$$\sum_{i=1}^{K} \rho I_i. \tag{24}$$

The following theorem shows that Eq. (20) can be adapted to separate this total demand for shares into demand for big company shares (from a clientele of large investors) and demand for small-company shares (from a clientele of small investors).

THEOREM 1 (Investor Clienteles). *In equilibrium, for any small-firm premium* $(P^b - P^s)$, *all investors above a certain size*

$$I^* = \frac{4(\varphi^s \varphi^b)^2 (P^b - P^s)^3}{27c((\varphi^b)^{2/3} - (\varphi^s)^{2/3})^3} \tag{25}$$

choose to invest in large-company shares, while all investors with a size below I^* *choose to invest in small-company shares.*

Proof. This result can be shown by applying Eq. (20) which has a similar result to this theorem; however, the small-firm premium $(P_o^b - P_o^s)$ in that equation is the counterfactual small-firm premium that would exist without the given investor's trades. The proof of this theorem therefore consists of considering that form of the premium and applying Eq. (20).

For a given counterfactual small-firm premium $(P_o^b - P_o^s)$, denote as $\tilde{I}$ the value of I which causes Eq. (20) to hold with equality. The theorem is proved by showing that investors with size $I > I^*$ do not wish to switch to small-company shares and investors with size $I < I^*$ do not wish to switch to large-company shares. Large-company investors will drive up the prices only of large-company stocks, so $P_o^b < P^b$ and $P^s = P_o^s$. Therefore, $(P_o^b - P_o^s) < (P^b - P^s)$ and $\tilde{I} < I^* < I$ so by Eq. (20) the large investor doesn't want to switch. Similarly, for the small-company investors, $P_o^s < P^s$ and $P_o^b = P^b$, so $(P_o^b - P_o^s) < (P^b - P^s)$ and $\tilde{I} > I^* > I$. Q.E.D.

Given this theorem, for any small-firm premium $(P^b - P^s)$ and associated critical size I^* given by Eq. (25), the demand for small-company shares is given by

$$\sum_{i: I_i \leq I^*} \rho I_i \tag{26}$$

and the demand for large-company shares is given by

$$\sum_{i: I_i \geq I^*} \rho I_i. \tag{27}$$

In the event that the critical value I^* equals I_i for some i, investors of size I are indifferent between large-company and small-company shares and will be willing to hold either or both in equilibrium. Theorem 1 thus shows that demand for each type of shares is decreasing in the expected price of the shares. The fact than an equilibrium exists between supply and demand can now be shown by the following theorem.

THEOREM 2 (Existence of Equilibrium). *There exist equilibrium prices P^b and P^s such that the markets for large-company and small-company shares clear.*

Proof. In an equilibrium, the average realized market prices in the supply Eqs. (22) and (23) must be equal to the expected market prices implicit in the values of I^* in Eqs. (26) and (27). Without imposing a specific distribution on I, it is not possible to solve explicitly for the prices of the two types of assets. However, it can be shown constructively that such an equilibrium exists. To show this, assume for the moment that all investors choose to invest all of their funds in the market. The sufficient condition for this is that the higher-priced large-company shares have a low enough price that the largest investor (of size I_K) has non-negative expected profits.

Consider first the supply and demand for shares in the aggregate, without regard to whether the supply and demand will be of large-company shares or small-company shares. As Eq. (24) makes clear, this total demand is perfectly inelastic. Since both large-firm supply (see Eq. (23)) and small-firm supply (see Eq. (22)) are increasing and linear in their own price, there will be a price $\tilde{P}$ such that if $P^b = P^s = \tilde{P}$ the total demand for shares equals the total supply of shares.

At this common price $\tilde{P}$, however, supply is split between large-company and small-company shares, while Eq. (25) shows that due to the liquidity advantage, all of the demand will be for the large-company shares. From this point, P^b can be increased while simultaneously decreasing P^s by an amount such that total supply is unchanged. (This operation must be possible since the supply of each type of share is linear in its price.) Equation (23) shows that this operation increases supply of large-company shares. Since total demand is perfectly inelastic, this operation will keep the total quantity demanded for shares equal to the total supply of shares. However, Eq. (25) shows that as this small-firm premium $P^b - P^s$ increases, demand shifts from large-company stocks to small-company stocks. This occurs in stages, with investors of each size I_i shifting to small-company stocks when the small-firm premium becomes (weakly) greater than the liquidity costs (for investors of their size) of the small-company shares. This operation can continue until the markets for big company shares clear. By Walras' Law, the market for small-company shares will then clear.

The above proof rested on the assumption that it would be profitable (in expectation) for all investors to purchase stock. If the price P^{b} is so high that the largest investors (of size I_K) do not find it profitable to invest, they will drop out of the market. This will lower demand for all shares, which will result in a lower price until the point at which the highest remaining investor does indeed find it worthwhile to invest. The constructive proof of equilibrium then applies in exactly the same manner, with some investors being so large that they choose not to purchase shares.

Q.E.D.

4.2. *Firm Size and Dividend Payout*

Attention can now be turned to the question of the cross section of dividend payout for the equilibrium derived in the previous section. For small-company shares, Eq. (26) shows the total demand for these shares. The function $D(I)$ then gives the number of these shares demanded by investors who prefer dividends as

$$\sum_{i:I_i \leq I^*} D(I_i)\rho I_i. \tag{28}$$

To minimize the cost of equity capital, company managers will switch to the dividend payout policy offering the higher expected price. Since this payout decision is costless to the firm, the expected price of dividend-paying and non-dividend-paying stocks will be equal. The fraction θ^{s} of small companies which will then choose to pay dividends is therefore equal to the fraction (weighted by shares held) of those investors who prefer dividends. Therefore,

$$\theta^{\mathrm{s}} = \frac{\sum_{i:I_i \leq I^*} D(I_i)\rho I_i}{\sum_{i:I_i \leq I^*} \rho I_i}. \tag{29}$$

Since $D(I)$ is strictly increasing, it is clear that

$$\theta^{\mathrm{s}} \leq \frac{\sum_{i:I_i \leq I^*} D(I^*)\rho I_i}{\sum_{i:I_i \leq I^*} \rho I_i} = D(I^*). \tag{30}$$

Again since $D(I)$ is strictly increasing, the inequality in Eq. (30) will be strict unless $I^* = I_1$, that is, the smallest investor is indifferent between the two types of shares.

For the large company, the fraction of companies paying dividends is similarly given by

TABLE I
DEFINITION OF VARIABLES

Name	Definition
ISPAYING	Dividend payout dummy variable
YIELD	Dividend yield (dividends/market capitalization)
MKTCAP	Market Capitalization (log)
HOLDERS	Number of shareholders (log)
BIDASK	Bid–ask spread (log)
PRICESALES	Price-to-sales ratio (log)

$$\theta^{\mathrm{b}} = \frac{\sum_{i:I_i \geq I^*} D(I_i)\rho I_i}{\sum_{i:I_i \geq I^*} \rho I_i} \geq \frac{\sum_{i:I_i \geq I^*} D(I^*)\rho I_i}{\sum_{i:I_i \geq I^*} \rho I_i} = D(I^*), \tag{31}$$

where the inequality must be strict unless $I^* = I_K$, that is, the largest investor is indifferent between the two types of shares.

Combining Eqs. (30) and (31) and noting that $I_K \neq I_1$ generates

$$\theta^{\mathrm{s}} < \theta^{\mathrm{b}}. \tag{32}$$

Equation (32) is the key theoretical result of this paper. *Large companies are more likely than small companies to pay dividends.* This result arises since the large investors who tend to own large companies (by Eq. (25)) are likely to be the institutional investors who prefer dividends.

5. EMPIRICAL TESTS

5.1. *Data Description*

The above implications for the cross section of dividend payout can be tested on the data. 1992 and 1993 financial data for U.S. corporations has been taken from the COMPUSTAT tapes. Trading data has been taken from the NYSE Trade and Quotes (TAQ) CD-ROM. Matching was done by ticker symbol for stocks listed on the New York Stock Exchange or the American Stock Exchange. 1958 companies reported all the relevant data, defined in Table I.

The data used in the analysis are summarized in Table I. Natural logarithms have been taken of all independent variables. First, the dependent variable of interest is the dividend decision of corporations. The most straightforward prediction of the model concerns whether a company chooses to pay dividends or not. The variable ISPAYING therefore is a dummy variable set to one if and only if the company paid dividends on its common shares during 1993. In addition, the amount of dividends paid by a corporation can be summarized by the ratio of dividends paid to market capitalization. This ratio, calculated by dividing the 1993 dividend by the end-1992 market capitalization (to avoid endogeneity problems), is the YIELD variable. By examining each of these variables separately, the question of the nature of the dividend preference of the large-company shareholders can be addressed. If the effects show primarily on the YIELD regressions, then this suggests that the large-company shareholders have a strong preference to receive dividend income rather than capital gain income. If the regressions on the ISPAYING dummy variable are more significant, however, this suggests that the large-company shareholders have a preference for dividend-paying companies *per se*, rather than the dividend income itself. This could be due to fiduciary guidelines that consider dividend-paying companies inherently more "prudent" as an investment.

The prediction of the model is that large firms are more likely to pay dividends. This is because large firms are more liquid, and the institutional investors that prefer dividend-paying stocks for fiduciary reasons also are large in size and need liquid stocks. Market capitalization is the obvious measure of the size of a company and is represented by the MKTCAP variable. To measure liquidity directly, the bid–ask spread as a percentage of the share price is included as BIDASK. Specifically, BIDASK is calculated as the median bid–ask ratio (as a percentage of the middle of the bid–ask spread) for one day's trading (January 18, 1994). Only quotes from the NYSE and AMEX are included in the calculations, to avoid distortions arising from different microstructures on different exchanges. In addition, the number of shareholders (HOLDERS) is included as this is the means in the model by which size is linked to dividend payout. Large companies have more shareholders, and more people interested in trading the stock, and are therefore more liquid.

It has been argued both theoretically (by Bhattacharya (1979) and others) and empirically (for example, by Bernheim and Wantz (1995)) in the literature that one function of dividends is the signaling of unobservable financial strength by managers with superior information. If dividends are performing this function, then a company which pays dividends should carry a higher market capitalization than a company which has identical publicly available information (such as its balance sheet) but which does not pay dividends. In other words, ratios such as price-to-earnings and price-to-sales should be higher for companies which pay dividends if the signaling hypothesis is correct. Although the price-to-earnings ratio is perhaps the obvious one to test, this creates problems in cross-sectional data due to companies with very low or negative earnings in the year being examined. Therefore, to

TABLE II
PROPERTIES OF INDEPENDENT VARIABLES

	BIDASK	MKTCAP	HOLDERS	PRICESALES
10%	0.20	18.8	524	0.26
25%	0.31	67.5	1270	0.48
Median	0.54	315.5	3531	0.95
75%	1.01	1434.8	13274	1.74
90%	1.95	4460.4	42790	3.74
Skewness	0.440	−0.068	0.318	0.548
Kurtosis	3.018	2.536	3.205	5.806

Note. Shown are the percentile breakpoints (in levels) of the independent variables. BIDASK is as a percentage of the average of the bid and the ask, MKTCAP is in millions of dollars, and HOLDERS and PRICESALES are in the units shown. Also shown (for the log data) are the skewness and kurtosis. The skewness statistic (zero for normal distributions) is the third moment normalized by the cube of the standard deviation and the kurtosis statistic (three for normal distributions) is the fourth moment normalized by the square of the variance.

control for the signaling effect of dividends, the price-to-sales ratio is included as PRICESALES.

Table II shows the several percentile boundaries of each of these independent variables. These will be used to examine the economic magnitudes of the empirical relationships analyzed later. So that these levels can be better understood by the reader, the variables are shown before logarithms have been taken. As the skewness and kurtosis (of the logged series) show, the distributions of the independent variables are not quite normal, but they do not have the sort of fat tails which would result in the analysis being dominated by a small number of large firms.

5.2. *Tests on The Dividend Decision*

Table III gives the analysis of the dividend payout decision. The table presents probit analysis where the dependent variable is unity if and only if the company paid any dividends. The results show that the dividend decision is quite robustly positively correlated with company size and the liquidity of the company's shares. Column 1 shows that liquid companies (as measured by a small bid–ask spread) and large companies (as measured by a high market capitalization) are more likely to pay dividends. Both variables are easily significant at the 1% level. The next two columns show that this measure is still robust if the number of shareholders is substituted for the market capitalization or if the two measures are used together.

The latter three columns of Table III include the PRICESALES variable, designed to test the signaling hypothesis of dividends. Dividend signaling models generally imply that the *level* of dividends is the important factor,

TABLE III
PROBIT ANALYSIS OF DIVIDEND DECISION

	1	2	3	4	5	6
BIDASK	−0.3936**	−0.7275**	−0.4019**	−0.8310**	−0.3844**	−0.4019**
	(0.0635)	(0.0442)	(0.0640)	(0.0417)	(0.0638)	(0.0640)
MKTCAP	0.2537**		0.2059**		0.2523**	0.2059**
	(0.0281)		(0.0313)		(0.0281)	(0.0313)
HOLDERS		0.1547**	0.0850**			0.0850**
		(0.0224)	(0.0254)			(0.0254)
PRICESALES				0.0503	0.0411	0.0498
				(0.0276)	(0.0277)	(0.0279)
Constant	−3.0719**	−3.5576**	−2.9509**	−3.8970**	−3.0176**	−2.9509**
	(0.2300)	(0.2171)	(0.2335)	(0.2130)	(0.2328)	(0.2335)
Pseudo R^2	0.2361	0.2222	0.2413	0.2045	0.2370	0.2143
N	1958	1958	1958	1958	1958	1958
χ^2	613	576	626	531	615	626
Log likelihood	−991	−1009	−984	−1032	−990	−984

Note. Standard errors in parentheses.
* 5% significance.
** 1% significance.

not the simple decision of whether to pay dividends at all. The effect may therefore be weaker than for the size and liquidity variables, which the present model predicts will impact the dividend decision itself. Indeed, this turns out to be the case. The coefficients of PRICESALES are positive, suggesting that dividends are conveying some information not otherwise available. However, the coefficients are not statistically significant.

Table IV describes the economic, rather than the statistical, significance of the variables. The coefficients are taken from the probit specification in column 6 of Table III. In each column, one independent variable is considered at five points along its sample distribution while the other three independent variables are held at their sample means. Shifting the bid–ask

TABLE IV
ECONOMIC SIGNIFICANCE OF MULTIVARIATE PROBIT ESTIMATES

	BIDASK	MKTCAP	HOLDERS	PRICESALES
10%	0.801	0.436	0.594	0.637
25%	0.745	0.541	0.623	0.648
50%	0.669	0.663	0.655	0.661
75%	0.573	0.764	0.696	0.672
90%	0.467	0.833	0.729	0.685

Note. Shown are the estimated probabilities of dividend payout by percentile boundaries from the multivariate probit in Column 6 of Table III. While examining each variable at its percentile boundaries, the other variables are fixed at their sample means.

TABLE V
DETERMINANTS OF DIVIDEND YIELD

	1	2	3	4	5	6
BIDASK	−0.0042*	0.0000	−0.0056**	−0.0029**	−0.0030	−0.0044*
	(0.0020)	(0.0013)	(0.0020)	(0.0011)	(0.0020)	(0.0019)
MKTCAP	0.0002		−0.0037**		−0.0000	−0.0043**
	(0.0009)		(0.0010)		(0.0008)	(0.0010)
HOLDERS		0.0047**	0.0062**			0.0067**
		(0.0007)	(0.0008)			(0.0008)
PRICESALES				0.0058**	0.0058**	0.0066**
				(0.0009)	(0.0009)	(0.0009)
Constant	0.0011	0.0171**	0.0070	0.0091	0.0089	0.0164
	(0.0068)	(0.0062)	(0.0067)	(0.0059)	(0.0068)	(0.0068)
Adj. R^2	0.0075	0.0324	0.0392	0.0284	0.0279	0.0655
N	1958	1958	1958	1958	1958	1958
F	8.37	33.76	27.61	29.59	19.72	35.31
Root MSE	0.0444	0.0438	0.0437	0.0439	0.0439	0.0431

Note. Standard errors in parentheses.
* 5% significance.
** 1% significance.

ratio from its lower quartile boundary to its upper quartile boundary, for example, lowers the likelihood of dividend payout from 75 to 57%. The same quartile change in market capitalization increases the likelihood of dividend payout from 54 to 76%. The magnitude of the economic effect of the number of shareholders and (especially) the price-to-sales ratio is much smaller. For example, changing the price-to-sales ratio from its lower quartile boundary to its upper quartile boundary increases the likelihood of dividend payout only from 65 to 67%. This result is in keeping with the statistical significance tests provided above.

5.3. *Tests of Amount of Dividends Paid*

Untaxed institutions face no tax penalty on dividends and may have fiduciary reasons to buy dividend-paying stocks if such stocks are deemed inherently "prudent." The model described this demand as being for dividend-paying stocks *per se*. Accordingly, the immediately relevant empirical tests are the probit analyses above. However, these institutions may also have fiduciary or other reasons to collect a large *amount* of dividends. To determine whether this is the case, the dependent variable can be changed to dividends paid as a proportion of market capitalization. The effects of the above proxies for size and liquidity on the level of dividend payout can then be examined.

Table V reports the same specifications of independent variable as Table III reported for the probit analysis of the dividend decision. Here, however, OLS regressions are analyzed where the dependent variable is the dividend yield, defined as the dividends paid in 1993 divided by end-1992 market capitalization. If the liquidity effect of the dividend decision also applies to the level of dividends paid, measures of liquidity such as the bid–ask spread will be related to the dividend yield. To the extent that size, as measured by market capitalization, retains some information about liquidity after the bid–ask spread is controlled for, MKTCAP would be expected to also be correlated with dividend payout, but not necessarily a large amount of dividends paid.

The number of shareholders (HOLDERS) may also represent the liquidity in a stock, as seen in the probit analysis earlier. It may also represent the monitoring costs associated with large corporations, in which case a company with many shareholders may pay dividends to ameliorate the principal–agent problem between owners and managers. This argument implies that HOLDERS may be positively correlated with the decision whether to pay dividends (for reasons described in the present model) and the decision to pay a large amount of dividends (for informational and monitoring reasons). Finally, the price-to-sales ratio (PRICESALES), which controls for the signaling function of dividends, would be expected to work entirely on the level of dividends rather than the decision of whether to pay any dividends at all.

Looking at Table V, the results for the bid–ask spread, while still suggestive of liquid companies paying more dividends, are statistically weaker than in the probit analysis. This suggests that, consistent with the model, the present argument about size and liquidity has more relevance for the decision of whether to pay any dividends than for the decision of how much to pay in dividends. Market capitalization shows an even stronger change from Table III, with even the sign of the coefficient not being robust to alternative specifications. Indeed, the model does not predict that size will be important to the dividend decision once liquidity has been properly controlled for.

The number of shareholders is consistently significant at the 1% level, with more shareholders implying a higher level of dividend payout. Also, the price-to-sales ratio, unlike in the probit analysis, is now consistently and strongly significant. This suggests, as we would expect, that the signaling function of dividends has a stronger effect on the level of dividends than on the decision of whether to pay dividends.

Table VI analyzes the economic significance of the coefficients in the last column of Table V. The first two columns should be viewed with some caution as the signs of the coefficients for the bid–ask spread and market capitalization were not consistent through the various specifications of Table V. However, they serve to give an idea of the economic meaning of the coefficients shown in column 6. Substantial changes in the dividend yield are associated with the coefficients found.

TABLE VI
ECONOMIC SIGNIFICANCE OF MULTIVARIATE YIELD ESTIMATES

	BIDASK	MKTCAP	HOLDERS	PRICESALES
10%	2.87%	3.59%	0.98%	1.53%
25%	2.67%	3.04%	1.58%	1.93%
50%	2.43%	2.38%	2.26%	2.37%
75%	2.15%	1.75%	3.15%	2.77%
90%	1.86%	1.24%	3.93%	3.28%

Note. Shown are the estimated dividend yields by percentile boundaries from the multivariate regression in Column 6 of Table V. While examining each variable at its percentile boundaries, the other variables are fixed at their sample means.

The second two columns of Table VI show the more reliable coefficients of the number of shareholders and the price-to-sales ratio. Holding the other variables constant at their sample means and increasing the number of shareholders from the lower quartile boundary to the upper quartile boundary virtually doubles the predicted dividend yield from 1.58 to 3.15%. Doing the same for the price-to-sales ratio increases the predicted dividend yield from 1.93 to 2.77%.

5.4. *Tests Involving Quoted Market Depth*

A perfect measure of liquidity would include far more information than the bid–ask spread. The immediate extension suggested would be the amount of stock that can be traded within that bid–ask spread. The DEPTH variable has been created to address this extension. First, the average dollar value of the number of shares available at the bid and ask prices were computed. Then the log of the average of the bidded shares and the asked shares is presented as the DEPTH variable. This variable has several problems as a proxy for liquidity. First, the number of shares reported is subject to a maximum, which may result in cross-sectional problems when the largest companies are included in the sample. Also, only the primary exchanges are included, which may also present cross-sectional difficulties. Finally, it suffers from the same limitations as the bid–ask spread as it represents only the shares available at the lowest ask and highest bid. In the case of quoted depth, when a small investor has made this ask or bid, this may be especially unrepresentative of the liquidity of the market.

In keeping with these limitations, Table VII shows broadly that the quoted depth is, as expected, positively correlated with the dividend decision in columns 1 through 4. However, when the bid–ask spread or market capitalization is presented as an alternative proxy for liquidity, the coefficient of quoted depth reverses sign. Table VIII looks at the dividend yield.

TABLE VII
QUOTED DEPTH AND THE DIVIDEND DECISION

	1	2	3	4	5	6	7
DEPTH	0.3144**	0.1909**	0.3017**	0.1716**	−0.0863**	−0.2151**	−0.3344**
	(0.0215)	(0.0251)	(0.0217)	(0.0255)	(0.0330)	(0.0367)	(0.0399)
BIDASK					−0.9547**		−0.5837**
					(0.0591)		(0.0697)
MKTCAP						0.5169**	0.3239**
						(0.0290)	(0.0352)
HOLDERS		0.2153**		0.2230**			0.1205**
		(0.0226)		(0.0229)			(0.0261)
PRICESALES			0.1136**	0.1297**			0.0505
			(0.0260)	(0.0262)			(0.0281)
Constant	−0.8247**	−0.6479**	−0.7733**	−0.5818**	−4.2145**	−1.7498**	−3.3564**
	(0.0825)	(0.0851)	(0.0836)	(0.0865)	(0.2312)	(0.1045)	(0.2460)
Pseudo R^2	0.0891	0.1254	0.0965	0.1349	0.2059	0.2346	0.2697
N	1958	1958	1958	1958	1958	1958	1958
χ^2	231	325	250	350	534	609	700
Log likelihood	−1182	−1135	−1172	−1122	−1030	−993	−947

Note. Standard errors in parentheses.
* 5% significance.
** 1% significance.

In keeping with the earlier findings that liquidity measures have a weak effect on the level of dividends paid, this noisier measure of liquidity has a very unreliable effect on the dividend yield.

6. CONCLUSIONS AND EXTENSIONS

I have developed a model that predicts that large corporations are more likely to pay cash dividends. This model derives its results from assumptions that have been empirically tested in the literature. First, markets are imperfectly liquid. Trading therefore incurs transactions costs. Second, institutional investors, for fiduciary and tax reasons, are more likely to buy companies that pay dividends. As these large institutional investors in this model own the large companies, managements of large companies (acting to minimize the cost of equity capital or to satisfy fiduciary responsibilities) are led to declare dividends on their companies' stocks.

This result is then confronted with the data. The results show that large companies and liquid companies are indeed the ones that are more likely to pay dividends. These results are both statistically and economically significant. The results also indicate, but not as strongly, that large companies and liquid companies are likely to pay a large *amount* of dividends. This suggests that the present model of size and liquidity has its strongest contribution in explaining the decision of whether to pay dividends at all. Other

TABLE VIII
QUOTED DEPTH AND DIVIDED YIELD

	1	2	3	4	5	6	7
DEPTH	0.0012	−0.0031**	0.0003	−0.0042**	−0.0022*	−0.0021	−0.0045**
	(0.0007)	(0.0008)	(0.0007)	(0.0008)	(0.0010)	(0.0011)	(0.0012)
BIDASK					−0.0073**		−0.0066**
					(0.0017)		(0.0020)
MKTCAP						0.0029**	−0.0028**
						(0.0008)	(0.0010)
HOLDERS		0.0062**		0.0065**			0.0072**
		(0.0007)		(0.0007)			(0.0008)
PRICESALES			0.0063**	0.0067**			0.0066**
			(0.0009)	(0.0009)			(0.0009)
Constant	0.0196**	0.0264**	0.0228**	0.0302**	−0.0053	0.0153**	0.0124
	(0.0027)	(0.0028)	(0.0027)	(0.0028)	(0.0064)	(0.0030)	(0.0068)
Adj. R^2	0.0010	0.0394	0.0252	0.0675	0.0097	0.0068	0.0722
N	1958	1958	1958	1958	1958	1958	1958
F	2.87	41.15	26.32	48.20	10.61	7.75	31.47
Root MSE	0.0446	0.0437	0.0440	0.0430	0.0444	0.0444	0.0429

Note. Standard errors in parentheses.
* 5% significance.
** 1% significance.

informational factors documented in the literature, such as monitoring and signaling, remain strong determinants of the level of corporate dividends.

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