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Shareholder Preferences and Dividend Policy

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ABSTRACT

This paper develops a theory of choice among alternative procedures for distributing cash from corporations to shareholders. Despite the preferential tax treatment of capital gains for individual investors, it is shown that a majority of a firm's shareholders may support a dividend payment for small distributions. For larger distributions an open market stock repurchase is likely to be preferred by a majority of shareholders, and for the largest distributions tender offer repurchases dominate.

A CORPORATION THAT PLANS to distribute cash to its shareholders may do so by way of a dividend or a share repurchase. In a celebrated paper, Miller and Modigliani (1961) demonstrated that in a perfect market setting shareholders would be indifferent between share repurchases and the payment of dividends. As with their other indifference propositions in corporate finance, this is a delicate result and the optimal policy, instead of being a matter of indifference, becomes a corner solution as soon as a single confounding factor such as personal taxes is introduced. However, the prediction that corporations will distribute cash to shareholders by way of repurchases only, in order to avoid the adverse tax consequences of dividends, is clearly counterfactual, and the challenge remains to explain the survival of dividends in the age of the income tax.

The continuing popularity of dividends[1] has been rationalized by a number of writers as a costly signalling device that permits the managers of the firm to communicate their private information about the prospects of the firm to investors. The earliest models of this genre are those of Bhattacharya (1979, 1980); subsequent work includes the models of Heinkel (1978) and Miller and Rock (1985) in which the signal is the dividend net of stock issues[2] and the cost is the cost of a non-optimal investment policy, and the model of John and Williams (1985) which explicitly relies on the taxability of dividends. A common feature of these models is the dependence of the utility of corporate insiders or managers

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[1] U.S. shareholders received $49.4 billion of taxable dividend income in 1984.

[2] These models do not recognize the taxable status of dividends and the signalling cost comes from a suboptimal investment policy, so they do not explain the persistence of dividends when repurchases are tax preferred.

on both the current stock price and the end of period distribution of cash flows from the firm. Recent research has extended the earlier models, which took the choice of dividend signal as exogenous, to a setting in which dividends are selected as the most efficient signal (Ambarish, John, and Williams (1987), Williams (1988), and Ofer and Thakor (1987)). Whereas in all of the foregoing the signal is fully revealing, Kumar (1988) presents a model in which the dividend signal is only partially revealing.

In this paper we offer a theory of the choice of method of corporate cash disbursement which does not rely upon an assumed asymmetry of information between the managers of the corporation and investors. Instead, we assume that the share price is not a perfect aggregator of the private information of investors about the prospects of the firm, and that the collection of information by investors is costly.[3] Under these circumstances share repurchases are no longer a costless alternative to dividends for shareholders, as in the Miller-Modigliani analysis, unless they are pro-rata repurchases. However, pro-rata repurchases are functionally equivalent to dividends, and are treated as such by the tax authorities; thus, they offer no tax advantage. Nonproportionate repurchases are costly because they oblige at least some shareholders to change their proportionate ownership in the corporation by trades, either explicit or implicit; for shareholders who are voluntarily or involuntarily changing their ownership share, the true value of their investment assumes an added importance because their exchanges may be with investors who possess superior information.[4] Thus, nonproportionate share repurchases oblige shareholders either to incur information collection costs, or to run the risk of partial expropriation by trade with better informed investors.[5]

Share repurchases may be accomplished either by means of an open market repurchase in which the shares are repurchased at prevailing market prices, or by means of a tender offer repurchase in which the corporation bids for a fraction

[3] See Verrecchia (1982) for a formal rational expectations model with costly information acquisition; a similar model is used in Diamond (1985) to analyze the optimal disclosure policy of firms. We do not formally model the determination of the equilibrium market price, so we cannot formally address questions related to shareholders' incentives to become informed at a cost when there is no corporate repurchase of stock.

[4] Barclay and Smith (1988) suggest that open market repurchases in which managers do not participate offer scope for them to expropriate uninformed shareholders. They find indirect evidence of this in the tendency of the bid ask spread to widen for firms planning open market repurchases. Consequently, they argue, a firm that makes frequent open market repurchases will have a higher cost of capital and a lower value cet. par. Our model differs from theirs in assuming away the agency problems that are the focus of their analysis. In our model the choice of cash disbursement mode is assumed to result from a majority vote of shareholders which depends on both the size of the disbursement and the size distribution of shareholdings.

[5] The concern with information costs is similar to that of Diamond (1985) who argues that a benefit of the corporate release of information is that it eliminates the incentive for private investors to waste resources by collecting the same information. However, while trade takes place in Diamond's model to accommodate portfolio rebalancing, in our setting there is no requirement for portfolio rebalancing and trade takes place only to accommodate nonproportionate repurchases. Our model is structurally similar to that of Rock (1986) who explains the underpricing of new issues of common stock by assuming that some investors have better information than do others. Where he is concerned with the issuance of new shares, we are concerned with the retirement of existing shares.

of the outstanding shares at a price in excess of the current market price.[6] What is important for our analysis is that in neither case can uninformed shareholders be assured of maintaining an unchanged share in the ownership of the corporation, because in neither case can they submit sale orders that depend on the sale orders submitted by others, including the informed shareholders. They can only place market orders in the case of an open market repurchase, or tender their shares in the case of a tender offer repurchase. In either case they run the risk that their actions will not be matched by those of the informed shareholders, so that they will tend to be left with a larger share of the company when the repurchase price is too high and with a smaller share of the company when the repurchase price is too low. Thus, we argue, share repurchases are likely to be associated with a redistribution of wealth between informed and uninformed shareholders.

The manner in which the repurchase is effected will have implications for the expected wealth redistribution between informed and uninformed shareholders, and therefore will create different incentives for the collection of information by shareholders. If, as we assume, there is a fixed cost of collecting information, large shareholders will have a greater incentive to become informed than will small shareholders. As a result, repurchases will tend to be associated with a redistribution of wealth from small shareholders to large shareholders. Our analysis considers the conditions under which dividends, or open market repurchases, or tender offer repurchases, are likely to be the chosen mode of cash distribution if the choice is made by majority vote of the shareholders. In general, we find that for small cash distributions dividends are likely to be observed so long as the tax rate on dividends is not too high, whereas for larger cash distributions repurchases are more likely, the precise outcome depending on the size distribution of shareholdings in the corporation, which we take as exogenous. These predictions rely on the wealth maximizing decisions of individual shareholders, rather than on an arbitrarily assumed objective function of a manager.

We have deliberately ignored the role of management as an informed party in the cash disbursement decision in order to focus on the effects of the potential wealth transfer between differentially informed shareholders in a repurchase. The role of management has been the focus of previous work on dividends and stock repurchases as signals[7] or as takeover deterrents. Such models are highly sensitive to the precise specification of the managerial objective function, and the difficulties of justifying an appropriate objective function, even when shareholders have the same information, are well known.[8] However, the analysis of

[6] A recent innovation is the issuance of share repurchase rights to shareholders by Gillette in August 1988. Seven rights permitted the shareholder to sell back to the company one share at a substantial premium above market value. For tax purposes the fair market value of the rights was treated as a dividend, and a shareholder who maintained his proportionate ownership share would have found the whole repurchase price treated as a dividend.

[7] The role of stock repurchases as a signal when management does not participate in the repurchase has been explored by Vermaelen (1984) and Ofer and Thakor (1987). Their role in deterring takeovers has been analyzed by Bagwell (1988) and Stulz (1988).

[8] See for example Dybvig and Zender (1987).

Fishman and Hagerty (1989) in a different context suggests that the existence of privately informed insiders might discourage the acquisition of costly information by the uninformed. In the context of our model this would tend to increase the fraction of uninformed shareholders, those most likely to support a dividend payment over a share repurchase.

The remainder of the paper is organized as follows: In Section II we describe the stylized facts concerning dividends, open market repurchases, and tender offer repurchases, and the tax rules that apply to them, and present our basic model. Section III is concerned with equilibrium share tendering strategies for informed and uninformed investors, given either a tender offer or an open market repurchase. Section IV analyzes the equilibrium information gathering strategies of investors for tender offers and open market repurchases, given the equilibrium tendering strategies developed in the previous section. Section V uses the foregoing to address the issue of which investors will be made best off by each of the three modes of cash disbursement, and considers the effect of the size of the cash disbursement on the type of disbursement which is likely to be approved by a majority of the shareholders. A numerical example is also presented. Section VI concludes.

I. Alternative Modes of Cash Distribution

According to a recent study by Barclay and Smith (1988), an average of 80.65% of the firms listed on the New York Stock Exchange paid dividends in any given year from 1983 to 1986; the corresponding figure for open market repurchases was 10.67%, and for tender offer repurchases was 0.76%.

Open market repurchases (OMR) which, like tender offer repurchases, are regulated by the Securities and Exchange Commission, involve corporate purchases of stock through a broker at prevailing market prices. There is currently no requirement that open market purchases be announced, though in practice most firms do announce them. However, since open market repurchase programs often extend over months and even years, it may be difficult for investors to determine whether open market repurchases are actually taking place on any given day, although firms do announce the completion of their repurchase programs. Tender offer repurchases (TOR), which have been studied by Dann (1981) and by Vermaelen (1981), typically specify the amount of stock to be repurchased at a given price, which is usually above the current market price; the company often reserves the right to extend the offer from its original term of three weeks to a month, the right to repurchase more shares, and the right, if more than the specified number of shares are tendered, to repurchase shares on a pro-rata basis. Although they are comparatively rare, typical tender offer repurchases are substantially larger in magnitude than typical open market repurchases.[9]

While dividends give rise to an immediate income tax liability for taxable investors, the situation with repurchases is more complex. Selling shareholders

[9] The data of Barclay and Smith (1988, Table 1) suggest that the average tender offer repurchase was about two and a half times as great as the average open market repurchase.

will, of course, be potentially liable to capital gains tax on the excess of the sale price over their cost basis. However, even if capital gains are taxed at the same rate as ordinary income as under the current tax law, an individual's tax liability under a repurchase is likely to be less than under an equivalent cash dividend since only a portion of the repurchase payment will be liable for tax. The tax bias towards repurchases is even stronger when capital gains are taxed at preferential rates. However, under Section 302 of the Internal Revenue Code a share repurchase will not qualify for preferential capital gains tax treatment but will be treated as a dividend unless either:

(i) The redemption of shares is "substantially disproportionate" *and* the shareholder owns less than 50% of the total voting power after redemption. A redemption is "substantially disproportionate" if, after the repurchase, the percentage ownership of the tendering shareholder is less than 80% of the ownership position before the repurchase.

(ii) The distribution is "essentially not equivalent" to paying a dividend. A pro-rata redemption of common stock is ordinarily treated as a dividend.

The effect of these provisions is to rule out favorable personal tax treatment for pro-rata repurchases.[10]

To analyze the choice of cash distribution channel we consider a setting in which the firm has an amount of cash C available for distribution to shareholders at time $t = 0$. We assume that the decision to distribute the cash has already been made,[11] and that the only issue to be decided is whether it should be distributed by way of dividend, a tender offer repurchase, or an open market repurchase.

In order to reflect in a simple manner the assumption that the share price is not fully revealing of the private information held by informed investors, we shall assume that the market opens each period $t = 1, 2, 3 \ldots$, and that at each market opening a market maker announces a price P_t. Investors then place orders with the market maker to trade at the announced price. The market maker takes no net positions but simply crosses orders at the announced price. If there is an order imbalance the market maker randomly rations one side of the market. After all feasible trades have been made at the current market price the market closes, and the market maker then announces a new price which reflects the information in the previous order flow, as well as any other information that has become *publicly* available.[12]

[10] Under Section 1.302-2 of the Internal Revenue Code, whenever a repurchase is treated as a dividend for tax purposes, the basis of the remaining stock is adjusted for future tax computations.

[11] DeAngelo (1987) points out that in a general equilibrium setting there will be a determinate cash distribution by firms to meet current consumption requirements, even if the distribution must be by way of (taxed) dividends.

[12] This model of the market maker contrasts with those of Kyle (1985) and Admati and Pfleiderer (1988) in which the market maker takes positions, but only accepts market orders which are executed at a price which leaves the market maker with zero expected profit conditional on the information in the order flow. Glosten and Milgrom (1985) and Copeland and Galai (1983) model a market maker who sets a bid and ask price at which he is willing to make a single trade. In Admati and Pfleiderer (1989) the market maker sets bid and ask prices which are good for a single period regardless of the order flow. The model in this paper differs from those of Kyle (1985) and Admati and Pfleiderer

In addition to the cash C, the firm owns a productive asset whose full information certainty-equivalent value is X^*. Thus, the full information value of the firm, P^*, is given by

$$P^* = X^* + C. \tag{1}$$

The sequence of events is then as follows. At $t = 0$ the firm announces its intention to pay a dividend or to repurchase shares. If a dividend is to be paid, it is paid immediately. Investors who decide to become informed collect information immediately and observe X^*. At $t = 1$ the market maker announces a price P_1 which depends only on the public information available. This information takes the form of a uniformly distributed signal X, about X^*, the value of the productive asset, where

$$X = X^* + \varepsilon \tag{2}$$

and ε is uniformly distributed on the interval $(-b, b)$. Thus the price announced by the market maker at $t = 1$ is

$$P_1 = X + C. \tag{3}$$

Transactions take place at the price P_1, and the price is then updated to reflect new public information as it becomes available. We assume that an individual shareholder's decision to become informed is known only to him. The timing of repurchases is described below.

Without loss of generality, we assume that the firm initially has a single share outstanding. We assume that shareholders pay tax on dividends at a rate τ which may be shareholder specific, and that there is no capital gains tax.[13] In order to model Section 302 of the Internal Revenue Code which treats pro-rata repurchases as dividends, we shall assume that a tender offer repurchase is treated as a dividend if the tender offer price is so high that the probability that the offer will be accepted by all shareholders, and therefore will be effectively pro-rata, exceeds some threshold probability, γ. While not conforming precisely to the current law, this assumption captures the spirit of the law, that repurchases cannot be "essentially equivalent" to dividends if they are to qualify for favorable tax treatment. Although this assumption does allow for pro-rata repurchases to be treated preferentially with some probability, in a more realistic setting, the heterogeneity of shareholders, which we do not attempt to describe, would prevent even those repurchases that turn out to be pro-rata in the model from being pro-rata in practice.

We model the three possible modes of cash distribution as follows:

A *dividend* is a pro-rata distribution of the cash, C, to shareholders, and is fully taxable to shareholders at the rate, τ.

(1988) in that the market price does not reflect the information in the current order flow. It differs from the other models in that the market maker plays a purely passive role and takes no net position. The market maker in this model is not necessarily an individual, and may be thought of as simply a market clearing mechanism.

[13] This assumption maintains a tax disadvantage to dividends and so makes the payment of dividends anomalous in the usual setting in which dividends are taxed more heavily than capital gains.

A *tender offer repurchase* (TOR) is an offer to repurchase a fraction $\hat{\beta}$ of the outstanding shares at a tender offer price P^T. P^T and $\hat{\beta}$ are chosen so that the whole amount of C is distributed if the tender offer is successful:[14]

$$\hat{\beta}P^T = C. \tag{4}$$

SEC rules preclude an individual shareholder from tendering more shares than he owns, and in order to simplify the analysis we assume that if either class of shareholder, informed or uninformed, tenders in equilibrium, it has enough shares to fully subscribe the offer.[15]

An *open market repurchase* (OMR) is a (possibly infinite) sequence of repurchase tender offers, in which the tender offer price P^T is equal to the current market price, P_t, which, as described above, is the price announced by the market maker based on public information; this is the expected value of the shares, given public information. For any given C, the target fraction β of shares repurchased satisfies $\beta P_t = C$. After all feasible trades at the current market price have been made, the market maker will quote a new price to reflect the information in the order flow or any other public information that has become available and, if the open market repurchase has not been completed, a tender offer at the new market price will be made, and so on. We assume that no new private information becomes available during the OMR process.[16] The sequence of repurchase tender offers terminates as soon as the offer is fully subscribed; given our assumption that either the informed or the uninformed class of shareholder can fully subscribe an offer, there are no partially subscribed offers in the model. While our model of OMR repurchases is highly stylized, it captures the essential feature of actual OMR's, that uninformed investors do not know the extent of OMR's on any given day. What is required for our analysis is that the uninformed investors not know whether the informed are tendering (i.e., the extent of the repurchase), even though they are aware that the firm has announced an OMR.

II. Equilibrium Share Tendering Strategies

In this section we describe the equilibrium share tendering strategies of informed and uninformed shareholders in response to tender offer (TOR) and open market (OMR) repurchases, given rational conjectures about the behavior of other shareholders. Lemma 1 characterizes the strategy of informed shareholders in response to TOR, given the conjecture that uninformed shareholders will always

[14] By buying back a fraction $\hat{\beta}$ of the outstanding shares at a price per share $P^T > P_1$, a fraction β of the firm is repurchased, where $\beta > \hat{\beta}$. Note that $\hat{\beta}P^T = C = \beta X[1-\beta]^{-1} = \hat{\beta}X_T[1-\hat{\beta}]^{-1}$.

[15] We also assume that shareholders do not alter their holdings unless a stock repurchase causes them to. That is, we take the pre-repurchase distribution of corporate ownership as exogenously fixed. This means that we preclude the possibility of shareholders with privileged information from strategically altering their ownership fractions prior to a repurchase and then increasing the wealth transfer to them during the repurchase.

[16] The effect of this assumption is to reduce the information advantage of informed shareholders in an OMR An alternative assumption, which would strengthen the results we obtain, would be that the information asymmetry does not change as a result of the company's failure to repurchase shares, because new information becomes available to the informed shareholders between successive tender offers.

tender; and to OMR, given the conjecture that uninformed shareholders will never tender. Lemma 2 establishes that there is a unique pure strategy Nash equilibrium in which uninformed shareholders always tender their shares in a TOR, provided that the fractional ownership of the uninformed is sufficiently high. Lemma 3 shows there is a pure strategy Nash equilibrium in which uninformed shareholders never tender their shares in an OMR, provided that the fraction of the shares to be repurchased is sufficiently high, and that it is not a Nash equilibrium for the uninformed to tender if there are any informed shareholders. In what follows, ω_I (ω_I^o) denotes the total fractional ownership by the informed shareholders and ω_U (ω_U^o) the total fractional ownership by the uninformed shareholders in a tender offer (open market) repurchase.

The proportions of shares owned by the informed in the different types of repurchases, ω_I and ω_I^o, are endogenously determined functions of the exogenous parameters of the model: the cost of information acquisition, the size of the cash disbursement, the magnitude of the information asymmetry, and the size distribution of shareholdings. However, the sufficiency conditions for most of our results will be stated in terms of these endogenous ownership proportions because it is not possible to relate them to the exogenous parameters of the model without very strong restrictions on the distribution of ownership. As we proceed, we will indicate the nature of the implied restrictions on the distribution of ownership; in general they require that ownership is sufficiently, but not too, diffuse. The restriction that the uninformed shareholders have sufficient shares to fully subscribe to a TOR, and the restriction that the informed can fully subscribe an OMR formally imply that if there are both informed and uninformed shareholders, then $\beta \leq \min\{\omega_u, \omega_I^o\}$. This restriction, which applies to every result in the paper, is a joint restriction on the size of the cash disbursement and the distribution of ownership.

LEMMA 1: a) *If uninformed shareholders always tender in response to a TOR, then informed shareholders will tender if and only if the tender offer price, P^T, exceeds the full information price, P^*.* b) *If uninformed shareholders never tender in response to an OMR, then there exists a Nash equilibrium in which informed shareholders will tender if and only if the tender offer price, $P^T = P_t$, exceeds the full information price, P^*.*

Proof: a) If the uninformed shareholders always tender, the offer will always be fully subscribed, and the number of shares that will be outstanding after the offer is completed will be $(1 - \hat{\beta})$. Therefore, the full information value of a share will be $X^*/(1 - \hat{\beta})$, and a rational informed shareholder will tender if and only if $P^T > X^*/(1 - \hat{\beta})$. But, using equation (4), this is equivalent to $P^T > X^* + C \equiv P^*$.

b) The open market repurchase is potentially a game with an infinite number of rounds. Suppose that in the first round, $P_1 > P^*$, and that the informed shareholders tender. By assumption, only the informed will tender and the offer will be successful; the fraction of each share tendered that is actually repurchased will be β/ω_I^o.[17] To show that it is rational for the informed shareholders to tender,

[17] This follows from the assumption that informed shareholders in an OMR have enough shares to fully subscribe the offer.

compare the payoff to an individual informed shareholder from tendering and not tendering. If he tenders, he realizes the tender offer price P_1 on the fraction of the share that is repurchased, β/ω_I^o, and the full information value, $X^*/(1-\beta)$ on the remaining fraction of his shares, so that his total payoff per share is

$$(\beta/\omega_I^o)\ P_1 + (1 - [\beta/\omega_I^o])\ P^*. \tag{5}$$

This will exceed $X^*/(1-\beta)$, the payoff per share from not tendering if and only if $P_1 > X^*/(1-\beta)$ or, since $\beta P_1 = C$, $P_1 > X^* + C = P^*$. Therefore, the informed shareholder will tender as hypothesized.

Now suppose that, to the contrary, $P_1 < P^*$. Assuming that the informed shareholders will not tender, the offer will fail since the uninformed shareholders never tender by assumption. Consider an individual informed shareholder. If he tenders he receives $P_1 < P^*$ per share. If he does not tender we move on to the second round. In this round the new market price is the price assessed by the uninformed market-maker, taking account of the information revealed by the failure of the first round offer: $P_2 = P_1 + b/2 > P_1$.[18] Hence, by rejecting the first round offer, the informed shareholder is assured of participating in a more attractive subsequent offer, and the first round offer is rejected as hypothesized. Similar considerations apply to subsequent rounds. Q.E.D.

The foregoing lemma allows us to characterize a set of Nash equilibrium tendering strategies for TOR and OMR in the following two lemmas.

LEMMA 2: *For a TOR, a necessary and sufficient condition for there to exist a unique pure strategy Nash equilibrium in which the uninformed always tender is that the fraction of shares collectively owned by the uninformed shareholders,* $\omega_U \equiv (1-\omega_I)$, *satisfies*

$$\omega_U > \left(\frac{P^T - P_1 - b}{P^T - P_1 + b}\right)^2, \tag{6}$$

where b is proportional to the noise in the public information about asset values. It cannot be a Nash equilibrium for the uninformed to never tender.

Remark: Uninformed shareholders tendering in a TOR face an adverse selection problem since the informed tender only when it is advantageous for them to do so. This causes the uninformed to be left with a smaller share of the firm when its true value is high than when it is low. As a result, uninformed shareholders are willing to adhere to the tender strategy only if there are not too many shares in the hands of informed shareholders. Holding all other exogenous parameters fixed, the inequality in Lemma 2 requires that there not be a few large shareholders who own a "sizeable" fraction of the firm.

Proof: Lemma 1 established that the informed will tender if and only if $P^T > P^*$. Suppose that the uninformed always tender so that the offer is successful, and consider the incentive for an individual uninformed shareholder to defect from the strategy of always tendering. If he does not tender, his expected payoff

[18] The failure of the first round reveals that the full information value is uniformly distributed on the interval $(P_1, P_1 + b)$.

per share is $X/(1-\hat{\beta})$. If he does tender and $P^T > P^*$ so that the informed tender also, a fraction $\hat{\beta}$ of his shares will be repurchased at the price P^T, and the remaining fraction $(1-\hat{\beta})$ will be worth $X^*/(1-\hat{\beta})$ per share. If he does tender and $P^T < P^*$, the fraction of his shares that will be repurchased at P^T is $\hat{\beta}/\omega_U$ and the remaining fraction $(1-(\hat{\beta}/\omega_U))$ will be worth $X^*/(1-\hat{\beta})$ per share. Define $X^T \equiv P^T - C$ as the implicit value placed on the asset by the tender offer. Then, recognizing that the informed will tender if and only if $X^T > X^*$, it will pay an individual uninformed shareholder to tender if and only if

$$\frac{X}{(1-\hat{\beta})} \leq \int_{X^T}^{X+b} \left[\frac{\hat{\beta}}{\omega_U} P^T + \left(1 - \frac{\hat{\beta}}{\omega_U}\right) \frac{X^*}{1-\hat{\beta}}\right] \frac{1}{2b}\, dX^* + \int_{X-b}^{X^T} [\hat{\beta}\, P^T + X^*] \frac{1}{2b}\, dX^*. \tag{7}$$

Recalling that $\hat{\beta} P^T = C$, this condition simplifies to

$$\omega_U \int_{X-b}^{X^T} \left(P^T - \frac{X^*}{1-\hat{\beta}}\right) dX^* > \int_{X^T}^{X+b} \left(\frac{X^*}{1-\hat{\beta}} - P^T\right) dX^*. \tag{8}$$

The LHS of condition (8) is proportional to the share of the gains from tendering which accrue to the uninformed when the tender offer price exceeds the full information value; the RHS is proportional to the losses from tendering when the tender offer price is less than the full information value—these losses are borne entirely by the uninformed. Thus, condition (8) is simply the requirement that the expected net gain from tendering is positive. Using equations (1), (3), and (4), condition (8) simplifies to condition (6), which is therefore necessary and sufficient for a Nash equilibrium in which the uninformed always tender.

Similar arguments can be used to eliminate the only other possible pure strategy Nash equilibrium in which the uninformed never tender, so the equilibrium described is unique. Q.E.D.

The intuition for this result is that if the uninformed shareholders choose not to tender, it always pays an individual uninformed shareholder to defect and tender. The reason is as follows. If, for any cash distribution C, an uninformed shareholder decides to tender, he loses only if the full information value of the firm exceeds P_T (and the informed shareholders do not tender). If an uninformed shareholder does not tender, he loses only if the full information value is less than P_T. Because $P_T > P_1$, the probability that the full information price exceeds P_T is always less than the probability that it falls below P_T.

Lemma 2 suggests that the price reaction to the announcement of tender offer success will be negatively related to the degree of oversubscription. If the TOR is 'heavily' oversubscribed, it is because the informed tendered, which implies that the TOR price was above the value discovered by the informed. Conversely, if the TOR is only moderately subscribed, it is because the informed have discovered that the firm value exceeds the tender price.

COROLLARY 2.1: *In a TOR, a necessary and sufficient condition for a Nash equilibrium in which the uninformed always tender is that $\omega_U > \pi^2$ where π is* *the ratio of the probability that the informed do not tender to the probability that they do.*

Proof: This follows from condition (6) and the observation that the probability that the informed do not tender is $(P_1 + b - P^T)/2b$. Q.E.D.

Again, the restriction on corporate ownership implict in this corollary is similar to that in Lemma 2. The following corollary is now immediate.

COROLLARY 2.2: *In a TOR in which there are no informed shareholders, a necessary and sufficient condition for all the (uninformed) shareholders to tender is that* $P^T > P_1$.

LEMMA 3: *In an OMR,* a) *it is not a Nash equilibrium for the uninformed to tender if there are any informed shareholders*; b) *there exists a pure strategy Nash equilibrium in which the uninformed never tender provided that* ω_I^o, *the fraction of investors who become informed satisfies*

$$\omega_I^o > \beta/(1 - \{4\beta/3\}), \tag{9}$$

where β *is the target fraction of shares in the OMR.*

Proof: a) An OMR in which the uninformed tender will be successful in the first round. It is therefore equivalent to a successful TOR in which $P^T = P_1$. Lemma 2 then implies that a necessary condition for a Nash equilibrium in which the uninformed always tender is that $\omega_U > 1$, which is impossible. b) It must be shown that if the uninformed do not tender, and the informed behave according to Lemma 1, then it is not optimal for an individual uninformed shareholder to defect from the proposed strategy by tendering. It is helpful to start by considering the expected payoff of the informed shareholders in the proposed equilibrium, since this is the complement of the payoff of the uninformed. We assume that in successive rounds of the OMR the firm tenders for the same fraction, β, of its outstanding shares at increasing prices.[19] The informed will tender the first time that $P_t \geq P^*$, where $P_t \equiv E[P^* \mid P^* > P_{t-1}]$ is the price announced by the market maker after the $(t - 1)$ repurchase bid has failed: it is the price at which the OMR tender is made.[20] Then it follows from the properties of the uniform distribution that $P_t = \frac{1}{2}P_{t-1} + \frac{1}{2}(P_1 + b)$. Solution of the above difference equation leads to the following expression for the price at which the tth OMR tender is made:

$$P_t = P_1 + b[1 - (\tfrac{1}{2})^{t-1}]. \tag{10}$$

[19] This assumption is made for analytic tractability; the alternative assumption is that the amount to be distributed by way of share repurchase remains constant. With this alternative assumption, an approximate (closed form) expression for the wealth per share of informed shareholders in an OMR is $P_1 + b\omega_U C[3\omega_I(X + \{b/8\})]^{-1}$. Details are provided in the Appendix. This approximates the actual wealth transfer per share to within 0.1% for reasonable parameter values. Our qualitative results are unchanged by this alternative specification.

[20] We are implicitly assuming that no new public information becomes available after the OMR is announced, except that information implicit in the order flow.

The full information wealth per share realized by the informed shareholders who tender at $P_t \geq P^*$ is, corresponding to expression (5),

$$(\beta/\omega_I^o)P_t + [(1 - (\beta/\omega_I^o))(X^* + C - \beta P_t)/(1 - \beta)], \tag{11}$$

where the second term allows for the possibility that βP_t, the amount spent on the repurchase, may not equal C; the difference is assumed to be made up by firm borrowing. The probability that the OMR will be completed on round t, $t \geq 1$, given $P_1 = X + C$, is $\pi_t \equiv (P_t - P_{t-1})/2b = [(1/2)^{t-1} - (1/2)^t]$, where $P_0 = P_1 - b$. Hence, the expected payoff per share to the informed shareholders, conditional on X, is, using (10) (11), and recalling that $\omega_U^o = 1 - \omega_I^o$,

$$[(1 - \beta/\omega_I^o))(X + C)/(1 - \beta)] + \beta \frac{\omega_U^o}{\omega_I^o(1 - \beta)} \sum_{t=1}^{\infty} P_t \pi_t. \tag{12}$$

Evaluating the summation and multiplying by ω_I^o, the expected total wealth of the informed is

$$\frac{(\omega_I^o - \beta)}{(1 - \beta)}(X + C) + \frac{\beta\omega_U^o}{(1 - \beta)}(P_1 + b/3), \tag{13}$$

or, since $P_1 = X + C$,

$$\omega_I^o P_1 + \frac{\beta\omega_U^o b}{3(1 - \beta)}. \tag{14}$$

The second term in expression (14) represents the expected wealth transfer from the uninformed to the informed shareholders on account of their informational advantage in the OMR. Hence, the expected payoff per share for an uninformed shareholder who follows the equilibrium strategy of not tendering is $P_1 - b\beta/3(1 - \beta)$.

Now consider the expected payoff per share to an uninformed shareholder who defects from the equilibrium and always tenders on the first round. With probability 1/2 he will be the only tendering shareholder and will realize P_1 per share. With probability 1/2, $X^* < X$ and all the informed will tender: a fraction β/ω_I of his shares will be repurchased[21] and the remaining fraction will have an expected payoff per share of $(X - (b/2))/(1/\beta)$. With probability 1/2, $X^* \geq X$ and all the informed refrain from tendering. Then he is the only tendering shareholder and he gets a payoff per share of P_1. Hence, his expected wealth from tendering on the first round is

$$\frac{P_1}{2} + \left(\frac{\beta}{2\omega_I^o}\right)P_1 + \frac{(1 - [\beta/\omega_I^o])}{2(1 - \beta)}\left(X - \frac{b}{2}\right) = P_1 - \frac{b[1 - (\beta/\omega_I^o)]}{4(1 - \beta)}, \tag{15}$$

where we have used the fact that $X/(1 - \beta) = P_1$. Comparing the expected payoff from tendering on the first round with the expected payoff from never tendering, it is apparent that the uninformed shareholder will have no incentive to tender on the first round provided that condition (9) holds. (The condition will be

[21] We are assuming that the shareholder is small enough that his tendering has no effect on the fraction of shares tendered that are repurchased.

satisfied provided that the cost of information acquisition is not too high. It is also more likely to be satisfied for low values of β than for high values.) Since condition (9) does not depend on the information asymmetry parameter, b, a similar argument holds for succeeding rounds even though the information asymmetry diminishes. That is, for any subsequent round after the first, the expected wealth from tendering for an uninformed shareholder is similar to (15) except that the term multiplying b is different (e.g. $P_2 = P_1 + b/2$). Thus, if (9) holds, the expected wealth from tendering is negative on *any* round. Hence, the strategy of never tendering is a Nash equilibrium under the stated condition. It can be shown that the other pure strategy of always tendering does not lead to a Nash equilibrium, so the Nash equilibrium described is unique. Q.E.D.

Condition (9), the lower bound on ω_I^0 required for the Nash equilibrium, can be understood as follows: equation (14) shows that the total loss suffered by the uniformed who do not tender is proportional to ω_U^0 and that the wealth gain per share of the informed is decreasing in ω_I^0. An uninformed shareholder who tenders enjoys the same gain as the informed when they tender and suffers a loss which is independent of ω_I^0 when he tenders alone. Thus a sufficiently large value of ω_I^0 is required to prevent defection by the uninformed.

There also exists a broader class of "strategic" equilibria with OMR's in which the uninformed do not tender and the informed tender on the tth round if and only if $P_t > P^* + \delta_t$ where $\delta_t > 0$.[22] It can be shown that in such equilibria the gain to the informed is an increasing function of $\kappa = \delta_t/b_t$, where b_t is the information asymmetry parameter on round t. The value of κ is limited by two considerations. For $\kappa \approx 1$ it will pay the uninformed to tender since the adverse selection problem they face in tendering will then be small. Secondly, for sufficiently large κ it will pay an individual informed shareholder to defect from the equilibrium and tender early since the gain from having all his shares accepted will outweigh the gains from waiting for a higher price. We do not consider this class of equilibria further, partly in order to conserve space, but more importantly because we believe that the strategic coordination they require between informed shareholders makes them less plausible than the equilibrium described above. In any case, it should be noted that these equilibria imply an even greater wealth redistribution to the informed than does the OMR equilibrium we have described.

III. Equilibrium Information Acquisition

To this point we have taken as exogenous the relative proportions of informed and uninformed shareholders. In this section we consider which shareholders will choose to become informed, given that there is a fixed cost $k > 0$ of observing X^*. As a preliminary, we state without proof the following lemma concerning information gathering strategies in an OMR.

LEMMA 4: *In an OMR, shareholders will either acquire information before the first repurchase tender offer or will not acquire information at all.*

[22] We thank Arnoud Boot, Phil Dybvig and Alan Kraus for alerting us to this class of equilibria.

The intuition behind this result is that the informational asymmetry is greatest before the first tender offer and diminishes as the number of failed repurchase attempts increases.

We consider first the equilibrium information gathering strategies for OMR.

THEOREM 1: *Given an OMR in which a fraction of the outstanding shares satisfying condition (9) is to be repurchased, there exists an* α_o^* *such that all shareholders with proportionate ownership* $\alpha \geq \alpha_o^*$ *become informed and all shareholders with* $\alpha < \alpha_o^*$ *remain uninformed.*

Proof: Multiplying expression (14) by α/ω_I^o, the expected wealth after information acquisition costs of an informed shareholder with proportionate ownership α, is

$$\alpha P_1 + \frac{\alpha\beta\omega_U^o b}{3\omega_I^o(1-\beta)} - k. \tag{16}$$

Also, from Lemma 3 the expected wealth of the shareholder if he remains uninformed is

$$\alpha P_1 - \frac{\alpha b\beta}{3(1-\beta)}. \tag{17}$$

Comparing expressions (16) and (17) it is apparent that a shareholder will choose to become informed if and only if $\alpha \geq \alpha_o^*$ where

$$\alpha_o^* = \frac{3\omega_I^o(1-\beta)k}{b\beta}. \tag{18}$$

Q.E.D.

THEOREM 2: α_o^*, *the critical ownership level at which shareholders choose to become informed in an OMR, is increasing in the information acquisition cost k, and decreasing in b, the measure of information asymmetry, and* β, *the fraction of the shares to be repurchased. Therefore, the number of shareholders who choose to become informed is (weakly) decreasing in k and increasing in b and* β.

Proof: Let $F(\alpha)$ denote the fraction of shares held by the shareholders who individually have proportionate ownership less than or equal to α. Then $\omega_I^o = 1 - F(\alpha_o^*)$ and (18) may be written as

$$\frac{\alpha_o^*}{[1 - F(\alpha_o^*)]} = \frac{3(1-\beta)k}{b\beta}. \tag{19}$$

The results follow since the LHS of (19) is increasing in α_o^*. Q.E.D.

This theorem confirms the intuition that more shareholders will become informed in a repurchase the greater are the benefits as measured by the information asymmetry and the size of the cash distribution to be made, and the lower are the information production costs.

The following theorem describes the equilibrium information acquisition strategies for tender offer repurchases.

THEOREM 3: *For a TOR in which some investors become informed and the uninformed tender, there exists an α_T^* such that all shareholders with proportionate ownership $\alpha \geq \alpha_T^*$ become informed and all shareholders with $\alpha < \alpha_T^*$ remain uninformed.*

Proof: A difference in the payoffs per share received by informed and uninformed shareholders arises only when $X^* > X^T$ (otherwise both groups tender). In this region the uninformed shareholders tender, receiving a payoff per share of $(\hat{\beta}/\omega_U)P^T + (1 - (\hat{\beta}/\omega_U))\, X^*(1 - \hat{\beta})^{-1}$; the informed do not tender, and receive a payoff per share of $X^*/(1 - \hat{\beta})$. Therefore, a necessary and sufficient condition for a shareholder with proportionate ownership α to wish to become informed is that

$$\frac{\alpha\hat{\beta}}{\omega_U}\int_{X^T}^{X+b}\left[\frac{X^*}{(1-\hat{\beta}} - P^T\right]\frac{1}{2b}\,dX^* \geq k. \tag{20}$$

Integrating, and noting that $(1 - \hat{\beta})P_T = X_T$, condition (20) implies that a shareholder will choose to become informed if $\alpha \geq \alpha_T^*$ where

$$\alpha_T^* = \frac{4bk(1-\hat{\beta})\omega_U}{\hat{\beta}(X+b-X_T)^2} = \frac{(1-\hat{\beta})k\omega}{b\hat{\beta}(1-\mu)^2} = \frac{(1-\beta)X_T\omega_U k}{bX\beta(1-\mu)^2}, \tag{21}$$

where $1 - \mu \equiv (X + b - X_T)/2b$ is the probability that the informed shareholders do not tender. Q.E.D.

Remark: There is no guarantee that either α_o^* or α_T^* will be the unique solution to (18) or (21). In case there is non-uniqueness, our convention is to take α_o^* as the minimum α satisfying (18) and α_T^* as the minimum α satisfying (21).

IV. Shareholder Preferences for Alternative Modes of Cash Distribution

In order to determine each shareholder's preferred mode of cash distribution it is necessary to calculate for each shareholder the unconditional expected payoff[23] per share under dividends, tender offer repurchases, and open market repurchases, if the shareholder follows his optimal information gathering strategy.

Thus, let $V_D(C, \tau_D)$ be the unconditional expected payoff per share to an investor with tax rate τ_D when the company distributes an amount C by way of a dividend. Since the dividend is taxable at the rate of τ_D, the expected payoff is given by

$$V_D(C, \tau_D) = P_1 - \tau_D C. \tag{23}$$

Note that the (unconditional) expected payoff is the same whether or not the shareholder collects information beyond that reflected in the price of the shares. Since information collection is costly there will be no information collection in

[23] We are concerned with the unconditional expected payoffs because we assume that shareholder preferences are expressed before the information is collected.

equilibrium if a dividend is paid. On the other hand, shareholders as a group will incur the tax costs $\tau_D C$, if they share a common tax rate τ_D.

Let $V_o(C,\alpha)$ denote the expected payoff per share to an investor with shareholding α who pursues the optimal information gathering strategy if the company distributes the amount C by means of an open market repurchase (OMR). It was shown following equation (14) above that if the shareholder remains uninformed and follows the equilibrium strategy of not tendering, his expected payoff per share when a fraction β of the shares is sought is $P_1 - b\beta/3(1 - \beta)$ *or*, since $\beta/(1 - \beta) = C/X$, the payoff per share is $P_1 - (b/3X)C$. Correspondingly, it may be seen from equation (14) that the expected payoff to a share net of information collection costs for a shareholder with holding α who collects information is $P_1 + [b(\omega_U^o)/3\omega_I^o X]C - k/\alpha$. Combining these results, $V_o(C, \alpha)$ is given by

$$V_o(C, \alpha) = \max(P_1 - \tau_o C, P_1 + [\tau_o \omega_U^o/\omega_I^o]C - k/\alpha), \tag{24}$$

where $\tau_o \equiv b/3X$ is the implicit tax rate paid by uninformed shareholders on an open market repurchase.

To calculate the expected payoff to shareholders in a TOR consider first the expected payoff per share to an informed shareholder, gross of information collection costs. This is given by

$$\frac{1}{2b}\int_{X-b}^{X^T} [C + X^*]\, dX^* + \frac{1}{2b}\int_{X^T}^{X+b} X^*/(1 - \hat{\beta})\, dX^*. \tag{25}$$

The first integral relates to the states in which the informed as well as the uninformed shareholders tender, whereas the second integral relates to the states in which the informed do not tender because $P^T < P^*$. Simplifying expression (25) using equation (3), the expected payoff per share to an informed shareholder may be written as $P_1 + [b(1 - \mu)^2/(2b\mu + X - b)]C$ where $\mu \equiv (X^T - X + b)/2b$ is the probability that the informed will tender so that the repurchase will be pro-rata. The second term in this expression represents the expected redistribution from uninformed to informed shareholders due to the superior tendering strategy of the latter. Denoting this by G, let L denote the loss per share suffered by uninformed shareholders due to their inferior tendering strategy. Since these gains and losses represent a pure redistribution, $\omega_I G = \omega_U L$. Using this result, the expected payoff per share to an uninformed shareholder is seen to be $P_1 - [b(1 - \mu)^2\omega_I/\omega_U(2b\mu + X - b)]C$. It may be verified that the redistribution gain and loss is decreasing in μ, the probability that the repurchase will be pro-rata, and therefore in the tender offer price P^T. We shall assume that management sets the tender offer price as high as possible consistent with the repurchase not being treated as a dividend for tax purposes.[24] This implies that $\mu = \gamma$, the maximum permitted probability of a pro-rata repurchase which is consistent with favorable tax treatment. Then $V_T(C, \alpha)$, the expected payoff per share to a shareholder with holding α if the firm distributes the amount C by way of a

[24] The presumption here is that management attempts to minimize wealth transfers from one group of shareholders to another. This corresponds to setting the tender offer price as high as possible, since the uninformed always tender in a TOR. Note this also minimizes costly information production by the shareholders; information production has only redistributive effects in our model.

tender offer repurchase, is given by

$$V_T(C,\alpha) = \max[P_1 - \tau_T C,\ P_1 + (\tau_T \omega_U/\omega_I)C - k/\alpha], \tag{26}$$

where $\tau_T(\omega_I) \equiv b(1-\gamma)^2\omega_I/\omega_U X^T$, is the implicit tax rate paid by uninformed shareholders on a tender offer repurchase, and $X^T = 2b\gamma + X - b$. Note that this tax depends on ω_I, the fraction of shareholders who become informed, and this in turn depends upon the size distribution of shareholders as seen in Theorem 4.

Figure 1 illustrates investor preferences between dividends and open market repurchases when $\tau_D < \tau_o$. In the upper panel the line DD gives the expected payoff if a dividend is paid. The line ABD gives the expected payoff for an open

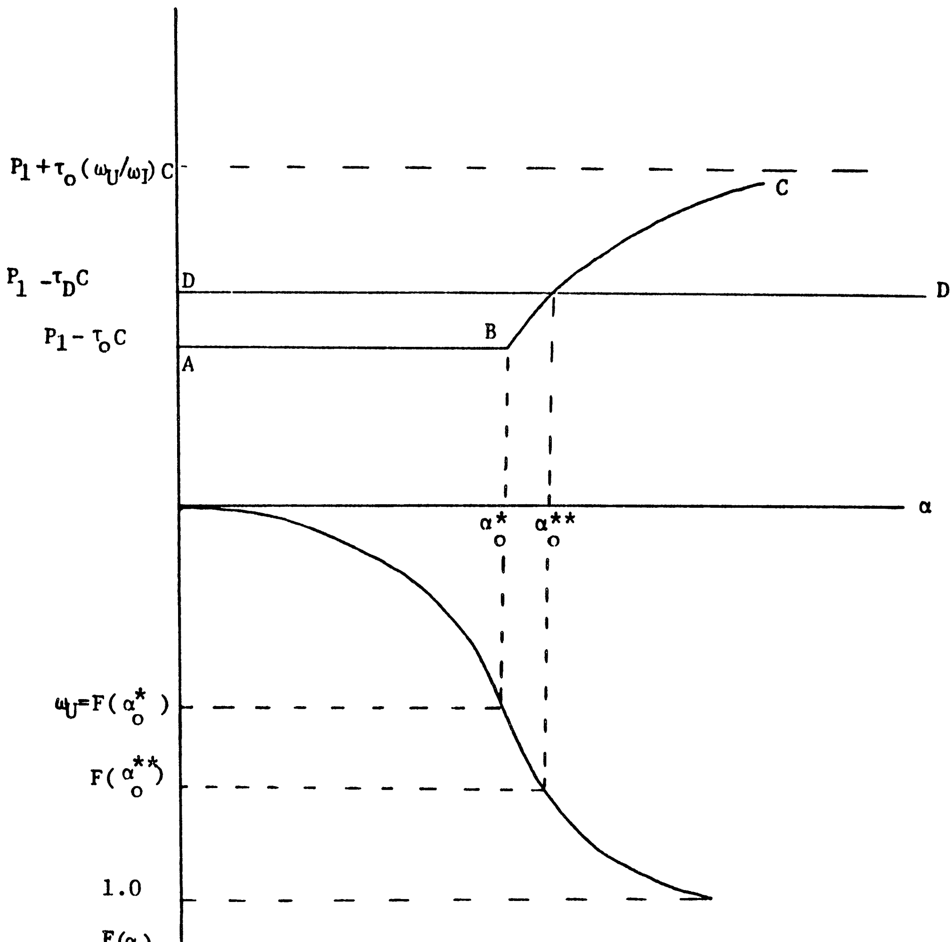

Figure 1. Investor preferences for open market repurchases and dividends. α_o, shareholding level at which shareholders become informed. α_o^{**}, shareholding level at which shareholders are indifferent between dividend and open market repurchase. $\omega_U = F(\alpha_o^*)$, fraction of shares held by uninformed in repurchase, $\omega_I = 1 - \omega_U$. $F(\alpha^{**})$, fraction of shares voted in favor of dividend. τ_D, tax rate on dividends. τ^o, implicit tax on uninformed in repurchase.

market repurchase calculated from expression (26). As the figure shows, shareholders with holdings greater than α_o^* become informed. However, all shareholders with holdings less than $\alpha_o^{**} > \alpha_o^*$ would be better off with a dividend than an open market repurchase; thus, even some of the shareholders who become informed if there is an OMR (and prefer an OMR after being informed) would have been better off with a dividend (before being informed). Shareholders with $\alpha \in (\alpha_o^*, \alpha_o^{**})$ are those for whom the expected wealth transfer in an OMR exceeds the information production cost which in turn exceeds the tax liability with a dividend. Whether a majority of shares would be voted for a dividend or a share repurchase depends upon the distribution of shareholdings and tax rates across shareholders. Clearly, all shareholders who pay no taxes and remain uninformed in a repurchase would strictly prefer a dividend and, as the figure shows, even shareholders with positive tax rates on dividends may yet be better off with a dividend.

The lower panel of the figure shows the cumulative distribution of shareholdings by size. Given the assumption that all investors share a common tax rate τ_D, all shares held by investors with $\alpha < \alpha_o^{**}$ would be voted for a dividend, and for the distribution of shareholdings shown in the figure, this constitutes a majority of the shares. The diagram for comparing payoffs under a tender offer repurchase with those under a dividend is similar to Figure 1 and is not shown. The relation between the two repurchase methods is described in the following theorem.

THEOREM 4 (OMR and TOR): (i) *A necessary and sufficient condition for uninformed shareholders to prefer a TOR to an OMR is that*

$$\frac{F(\alpha_T^*)}{1 - F(\alpha_T^*)} > 3(1 - \gamma)^2 X/X^T, \tag{27}$$

where $F(\alpha)$ is the fraction of shares held by investors with shareholdings less than α. (ii) Those shareholders who become informed in either the TOR or the OMR strictly prefer a TOR to an OMR, if the collective ownership of the informed shareholders in an OMR, $\omega_I^o > \omega_u^o X_T\{X_T + 3(1 - \gamma)^2 X\}^{-1}$. Otherwise an OMR is preferred to a TOR.

Proof: (i) Uninformed shareholders will prefer a TOR if and only if $\tau_T < \tau_o$. Noting that in a TOR $\omega_U = F(\alpha_T^*)$, $\omega_I = 1 - F(\alpha_T^*)$, and that $X^T = 2b\gamma + X - b$, this implies (27).

(ii) The expected wealth transfer per share to the informed in a TOR is $b(1 - \gamma)^2 C/X^T$ and in an OMR it is $bC\omega_u^o/3X\omega_I^o$. The claim now follows immediately. Q.E.D.

Note that it is not possible to make unambiguous statements about the effect of changes in the size of the distribution, etc., on the proportion of shares that would be voted for each type of distribution without knowing the distribution of shareholdings by size. This is because a change in the parameters not only affects the preferences of informed and uninformed shareholders but also changes the number of shareholders in each class. However, the restrictions on corporate ownership implied in (i) and (ii) are similar to those in Lemmas 2 and 3, respectively.

Note, though, that the inequality stated in part (ii) of this theorem implies that ω_I in an OMR must strictly exceed at least 4/7 (and hence ω_U) for a TOR to be preferred to an OMR,[25] and is likely to have to be much larger than that number. Hence, it will certainly be the case that for an intermediate size distribution for which the ω_I in an OMR lies in the interval (0.5, 4/7], an OMR will be preferred to a TOR by a majority of votes of the informed shareholders. For distributions sufficiently larger than that, a TOR may receive majority support.

THEOREM 5 (Dividends and Repurchases): (i) *A necessary and sufficient condition for an uninformed shareholder to prefer a dividend to an OMR is that his tax rate satisfies* $\tau_D < b/3X$. (ii) *A necessary and sufficient condition for an uninformed shareholder to prefer a dividend to a TOR is that his tax rate satisfies* $\tau_D < b(1-\gamma)^2\omega_I/X_T^T\omega_U$. (iii) *Define* $\alpha_o^{**}(\tau_D) \equiv k[bF(\alpha_o^*)\{3X(1-F(\alpha_o^*))\}^{-1} + \tau_D]^{-1}C^{-1}$. *Then if uninformed shareholders with tax rates* τ_D *prefer dividends to OMR, we have* $\alpha_o^{**}(\tau_D) > \alpha_o^*$ *and a shareholder with ownership* α *and tax rate* τ_D *will prefer dividends to OMR if and only if* $\alpha < \alpha_o^{**}(\tau_D)$. (iv) *Define* $\alpha_T^{**}(\tau_D) \equiv kC^{-1}[b(1-\gamma)^2(X^T)^{-1} + \tau_D]^{-1}$. *Then, if uninformed shareholders with tax rates* τ_D *prefer dividends to TOR, we have* $\alpha_T^{**}(\tau_D) > \alpha_T^*$ *and a shareholder with ownership* α *and tax rate* τ_D *will prefer dividends to TOR if and only if* $\alpha < \alpha_T^{**}(\tau_D)$.

Proof: (i) Follows from the definition of τ_o. (ii) Follows from the definition of τ_T. (iii) From a comparison of $V_D(C, \tau_D)$ and $V_o(C, \alpha)$ we see that shareholders who would prefer to be informed, conditional on an OMR, would nonetheless prefer a dividend ex ante to an OMR if, for these shareholders, $\alpha < \alpha_o^{**}(\tau_D)$. Moreover, it is straightforward to verify that $\alpha_o^{**}(\tau_D) > \alpha_o^*$ if and only if $\tau_o > \tau_D$, which is the condition for uninformed shareholders with tax rate τ_D to prefer a dividend to OMR. Thus, when $\tau_o > \tau_D$, *all* shareholders with tax rate τ_D (or lower) and $\alpha < \alpha_o^{**}(\tau_D)$ strictly prefer a dividend to an OMR. (iv) From a comparison of $V_D(C, \tau_D)$ and $V_T(C, \alpha)$ it follows that shareholders who would prefer to be informed, conditional on a TOR, would ex ante prefer a dividend to a TOR if, for these shareholders, $\alpha < \alpha_T^{**}(\tau_D)$. Moreover, it follows directly that $\alpha_T^{**}(\tau_D) > \alpha_T^*$ if and only if $\tau_T > \tau_D$, which is the condition for uninformed shareholders with a tax rate τ_T to prefer a dividend to a TOR. Thus, when $\tau_T > \tau_D$, all shareholders with tax rate τ_D (or lower) and $\alpha < \alpha_T^{**}(\tau_D)$ strictly prefer a dividend to a TOR. Q.E.D.

Although it is not possible to characterize fully the choice of method for corporate cash disbursement without specifying both the distribution of ownership and tax rates across shareholders and the voting mechanism,[26] further insight into the likely nature of choices may be gained from inspection of Table I. This table presents the implicit (or explicit) tax rates for informed

[25] This follows from the fact that $\gamma \geq 0.5$ to ensure that $X_T \geq X$.

[26] With a choice of three methods there is no assurance that majority shareholder preferences will be transitive.

Table I

Implicit Tax Rates for Informed and Uninformed Shareholders for Alternative Modes of Cash Disbursement

The implicit tax rate is the average cost per dollar of cash distribution due to taxes, information costs, and wealth redistribution. τ_D, explicit tax rate on dividends; b, measure of information asymmetry; X, value of productive asset assessed by uninformed; $\omega_I(\omega_U)$, fraction of shares held by informed (uninformed); X^T, implicit value placed on productive asset by tender offer; γ, probability of tender offer being taken up by informed; k, cost of information; α, holding of individual shareholder; C, size of cash distributed.

	Implicit Tax Rate for	
	Uninformed Shareholder	Informed Shareholder
Dividend	τ_D	τ_D
Open Market Repurchase	$b/3X$	$k/\alpha C - \omega_U^o b/3X\omega_I^o$
Tender Offer Repurchase	$\omega_I b(1-\gamma)^2/X_T\omega_U$	$k/\alpha C - b(1-\gamma)^2/X^T$

and uninformed shareholders for each of the three methods. In the case of repurchases, the tax rate reflects the expected wealth redistribution as well as the cost of gaining information.

Consider first the case in which a majority of the shares are owned by investors who would remain uninformed in the event of a repurchase of either type, and suppose that it is the votes of the uninformed that determine the outcome. This situation is mostly likely to obtain when the information cost is high or the distribution is small. As shown in Theorem 4, the uninformed will prefer the TOR to the OMR if there are sufficient shares in the hands of the uninformed in the TOR for condition (27) to be satisfied. However, if the cash distribution is so small that *no* investors become informed in the TOR then, as stated in Corollary 2.1, all (uninformed) investors will find it worthwhile to tender provided that $P^T > P_1$. But then the repurchase will be pro-rata for sure and will be taxed as a dividend. Therefore, under these circumstances the uninformed majority will prefer the OMR—or a dividend, if their tax rates are sufficiently low. Note that a standard deviation of (ε/X^*) of the order of 20% would, under the uniform distribution, imply a value of (b/X^*) of about 35%.[27] Then the *expected* implicit tax under the OMR, $E[b/3X]$, would be approximately 12%.[28] Thus information asymmetries of realistic proportions can imply a preference for dividends over repurchases for small distributions or when information costs are high, even when there is a significant tax disadvantage to dividends.

For larger distributions it will pay more shareholders to become informed because the net advantage of becoming informed is an increasing function of the size of the distribution. Consider then the situation in which the distribution is large enough to induce the owners of a majority of the shares to become informed

[27] Cf. Black (1986), "However, we might define an efficient market as one in which price is within a factor of 2 of value . . ."

Ho and Michaely (1988) report an average price drop of over 10% for a sample of firms that receive pessimistic evaluations from *Barron's* or the *Wall Street Journal.*

[28] The "strategic" equilibrium that we did not pursue would imply higher implicit tax rates under the OMR.

in the event of a repurchase, and suppose that it is the votes of the informed that determine the outcome. If the total ownership of the informed is only slightly greater than that of the uninformed, the informed will prefer an OMR to a TOR because of the larger wealth distribution they will receive under the OMR. Moreover, the larger is the distribution, the smaller is the information cost per unit of distribution, $k/\alpha C$, and the more likely it is that an OMR will be preferred to a dividend.

However, for very large distributions, it will pay most investors to become informed and $\omega_I \gg \omega_U$. Then the positive effects of the wealth distribution under an OMR become de minimis, as do the information collection costs. In the following example we show how the size of the distribution affects the choice between dividend, OMR and TOR for given tax rates and distribution of shareholdings.

Example 1: Tables II and III present an example to illustrate the effect of the size of the distribution on the choice of mode of cash distribution. The exogenous parameters, including the size distribution of shareholdings, are shown in Table II. Table III shows which shareholders become informed for three different size repurchases. For each size of distribution the threshold level of ownership at which it pays to become informed (α_o^*, α_T^*) is calculated from equations (18) and (21); α_o^{**} and α_T^{**} denote the ownership levels below which a dividend is preferred to each of the two types of repurchase; the net advantage of an OMR over a TOR to the informed is the difference between the two implicit tax rates on the informed shown on Table I. Finally, Table III shows for reference the conditions on the endogenous ownership fractions which are required to ensure that there are no partially subscribed offers and that the conditions of Lemmas 2 and 3 are satisfied.

Case (i) relates to a small cash distribution; under a TOR there would be no informed investors; as a result the TOR would be pro-rata and therefore equivalent to a dividend. (Variations of this example with more complicated ownership distributions are available in which $\omega_I > 0$ for small cash distributions and a dividend is strictly preferred to either a TOR or an OMR by those holding a majority of shares). If the cash is distributed by OMR, a majority of shares will be owned by uninformed investors; the implicit tax rate they pay exceeds the explicit tax on dividends—therefore the majority vote of the uninformed would

Table II

Numerical Values of Exogenous Parameters in Example 1

X, expected value of productive asset = 100; k, cost of information acquisition = 0.2; b, information asymmetry parameter = 30; γ, probability that informed tender in TOR = 0.67; τ_D, dividend tax rate = 0.07; X^T, value placed on productive asset by TOR = 110; $F(\alpha)$, fraction of shares owned by shareholders whose ownership does not exceed α (described below).

Distribution of Shareholdings					
α	0.050	0.060	0.083	0.110	0.170
$F(\alpha)$	0.167	0.250	0.417	0.417	0.553

Table III

Size of Distribution and Information Collection Per Dollar of Distribution in Example 1

	(i)	(ii)	(iii)
Target repurchase fraction: β	0.05	0.20	0.25
Cash distribution: C	5.26	25.00	33.33
Open Market Repurchase (OMR)			
Level of ownership at which			
investors become informed: α_o^*	0.170	0.060	0.050
investors prefer OMR to dividend: α_o^{**}	0.196	0.077	0.067
Fraction of shares held by			
uninformed: $\omega_u^o \equiv F(\alpha_o^*)$	0.553	0.250	0.167
informed: $\omega_I^o \equiv 1 - F(\alpha_o^*)$	0.447	0.750	0.833
Condition (9): $\omega_I^o > \beta/(1 - \{4\beta/3\})$	0.054	0.273	0.375
Implicit tax rate on informed	0.100	0.100	0.100
Tender Offer Repurchase (TOR)			
Level of ownership at which			
investors become informed: α_T^*	1.254	0.110	0.083
investors prefer TOR to dividend: α_T^{**}	n.a.	n.a.	n.a.
Fraction of shares held by			
uninformed: $\omega_U \equiv F(\alpha_T^*)$	1	0.417	0.417
informed: $\omega_I \equiv 1 - F(\alpha_T^*)$	0	0.583	0.583
Condition (6):			
$\omega_U > \{(P^T - P_1 - b)/(P^T - P_1 + b)\}^2$	0.250	0.250	0.250
Net advantage of OMR to informed	n.a.	0.003	−0.010
Necessary conditions on ownership proportions:			
OMR: $\omega_I^o \geq \beta$; $\omega_I^o > \beta/(1 - \{4\beta/3\})$			
TOR: $\omega_U \geq \beta$; $\omega_U > [(P^T - P_1 - 2b)/(P^T - P_1 + b)]^2$			

Note: $F(\alpha)$ is the fraction of shares owned by shareholders whose ownership does not exceed α.

elect the dividend over the OMR. Thus dividends are likely to be chosen for small distributions.

Case (ii) relates to a larger distribution. Now a majority of shares are held by informed investors under either repurchase. Moreover, informed investors do better in an OMR than in a TOR; therefore, if the distribution method is determined by vote of the informed majority, the OMR will be selected. Finally, Case (iii) relates to a still larger distribution; a larger majority of shares are now held by informed investors; as a result, their gain per share from an OMR is reduced and they are better off with the TOR which will be chosen if the outcome is determined by the votes of the informed majority.

Thus our model of information asymmetry, combined with the provisions of the Internal Revenue Code that preclude favorable tax treatment of repurchases that are close to pro-rata, is able to rationalize the payment of small distributions by way of dividends despite the adverse tax treatment, the payment of larger distributions by way of OMR, and the payment of the largest distributions by way of TOR. This seems to accord well with that we observe in practice. Individual open market repurchases, when they occur, are typically larger than dividend payments and, as mentioned in Section II, the typical TOR is over twice as large as the typical OMR.

V. Conclusion

We have offered a theory of the choice of corporate cash disbursement method that encompasses dividends, open market repurchases, and tender offer repurchases.[29] The theory suggests that dividends are likely to be the choice for the smallest distributions, and that tender offer repurchases will dominate for very large distributions; there may also be an intermediate range of distributions in which open market repurchases are favored. The theory relies solely on the preferences of wealth maximizing shareholders as manifested by an (unspecified) majority voting procedure. To this extent it may be regarded as more robust than theories which rely on a priori specification of a managerial compensation function.

The essential insight of the model is that share repurchases, if they are to qualify for favorable tax treatment, cannot be pro-rata. This nonproportional aspect of repurchases, which is not shared by dividends, renders less well informed shareholders vulnerable to expropriation by the better informed. With a fixed cost of information acquisition, it pays only the larger shareholders to become informed in a repurchase, so that it is the smaller shareholders who suffer the expropriation. As a result smaller shareholders tend to prefer dividends provided that their tax rates are not too high. As the size of the distribution increases it pays more shareholders to become informed in a repurchase. If the votes of the potentially informed determine the outcome, there will tend to be majority approval for OMR for intermediate size distributions and for TOR for the largest distributions. This is because the redistributive gain per share for the informed is a decreasing function of the fraction of informed shareholdings for an OMR but not for a TOR.

The empirical predictions of our model can be summarized as follows:

(1) Corporations will make small payouts through dividends, intermediate payouts through open market repurchases, and large payouts through tender offer repurchases.
(2) If the effective personal income tax rate on dividends is not too high, shareholders with sufficiently low ownership holdings will prefer dividends, whereas those with sufficiently high ownership holdings (and no lower tax rates) will prefer repurchases.
(3) The price reaction to the announcement of tender offer success will be negatively related to the degree of oversubscription.[30]

[29] In our model the manager has no private information, so that there is no announcement effect greeting an OMR, and no new information is revealed by the tender offer price in a TOR. Managerial private information—coupled with the manager behaving in his own best interest—may cause an even stronger preference for dividends on the part of uninformed shareholders.

[30] Recently, Kamma, Kanatas, and Raymar (1990) have found empirical evidence supporting this prediction.

We have not attempted to explain the distribution of ownership across shareholders which is an important determinant of how many shares are voted by potentially informed shareholders. Although it is outside our model, it is reasonable to expect that a firm that has a reputation for relying on repurchases rather than on dividends will tend to encourage the emergence of (high tax bracket) large block shareholders, since the advantage of repurchases is greatest for them. However, as Shleifer and Vishny (1986) point out, large shareholders are most likely to expend resources in monitoring management.[31] To the extent that management finds this undesirable and has influence over the choice of cash disbursement method, this additional consideration would further favor the payment of dividends.

Appendix: Approximation for Wealth Transfer in OMR When C is Held Constant Through Successive Periods

If we hold C constant, then the repurchase fraction, β, will decline from one round to the next in an OMR. This is because the repurchase price in round $t+1$ is higher than that in round t if the OMR failed in round t. Let β_t represent the repurchase fraction in round t and P_t the repurchase price in round t. Then we have

$$\beta_t P_t = C \ \forall t. \tag{A1}$$

It can be verified, after some algebra, that the wealth per share of an informed shareholder in this case is

$$P_1 + b\omega_U[\omega_I]^{-1} \sum_{t=1}^{\infty} \beta_t[1 - \beta_t]^{-1} (1/4)^t. \tag{A2}$$

The key is to evaluate the infinite series in (A2). Since the β_t's are a declining sequence, it is clear that the series is convergent. Unfortunately, we are unable to find a closed form simplification for it. However, note that $\beta_1[1 - \beta_1]^{-1} = C/X$, $\beta_2[1 - \beta_2]^{-1} = C[X + b/2]^{-1}$, $\beta_3[1 - \beta_3]^{-1} = C[X + 3b/4]^{-1}$, and so on. Through trial and error, one can see that if one approximates the infinite series with $C[3\{X + (b/8)\}]^{-1}$, then the error is less than 0.1% for a very wide range of reasonable parameter values. Hence, a close approximation to (A2) is

$$P_1 + b\omega_U C[3\omega_I(X + \{b/8\})]^{-1}.$$

Note that this differs from the expected wealth of the informed in an OMR with β held constant only by the term $b/8$, which is added to X in the denominator of the wealth transfer term.

[31] This is one aspect of gathering information in our model. Empirical evidence that large shareholders are more effective monitors may be found in Demsetz and Lehn (1985) and Holderness and Sheehan (1988). Unlike our model in which large (informed) shareholders prefer repurchases, the large shareholders in Vishny and Shleifer prefer dividends. In their model the argument follows from an assumed difference in tax treatments of small and large shareholders; the former prefer to have their cash flows taxed as capital gains, whereas the latter prefer to have them taxed as ordinary income. While we allow for possible heterogeneity in personal income tax rates across shareholders, we do not assume any systematic differences in those rates across small and large shareholders.

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