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# Shareholder-Value Maximization and Product-Market Competition

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***We investigate product-market competition when managers maximize shareholder value rather than their expected discounted value of profits. If shareholders are imperfectly informed about future profitability, shareholder-value maximization can lead to either more or less aggressive product-market strategies. Lower rivals' profits lead investors to believe that the firm's costs are low relative to those of its rivals and that the industry's prospects are poor. If the former (latter) inference dominates, each firm tries to lower (raise) its rivals' profits to increase its own stock price. We also consider implications for corporate financial structure.***

Financial economists typically assume that firms maximize shareholder value. Industrial economists typically assume that firms maximize the discounted value of profits. Sometimes these assumptions amount to the same thing; often they do not. In this article, we explore the product-market effects of shareholder-value maximization when these assumptions are not equivalent.

Miller and Rock (1985) and Stein (1989) show that the assumptions are not equivalent when information

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is imperfect.<sup>1</sup> Given that stock prices represent the (rational) forecast of the discounted value of profits, this may seem surprising. How can the maximization of this rational forecast differ from the maximization of the present value itself? The answer according to these authors is that under imperfect information, firms may have the ability to enhance investor perceptions (and thus the share price) even without actually increasing the discounted value of profits. In particular, firms can increase current profits at the expense of future profits by forgoing valuable investment projects. If investment is unobservable, and firms vary according to their inherent profitability, high current profits lead investors to believe that the firm is inherently more profitable.

This raises the question of why managers would maximize share value rather than their expectation of the firm's present discounted value of profits. One possibility is that the former objective is also that of current shareholders. Indeed, shareholders prefer a high future stock price if they intend to sell their shares for liquidity reasons or in response to a takeover bid. Shareholders will also want a high future stock price if the firm plans to issue more equity to finance new investment.

To exhibit the effects of shareholder-value maximization on product-market competition, we reconsider the standard Cournot oligopoly model. In our model, share-value maximizing firms maximize a weighted average of expected profits and stock price for the reasons described above: shareholders may sell their shares or the firm may issue equity. We introduce imperfect information by assuming that firms' costs (or the level of market demand) are stochastic and not directly observable by investors. Firms' costs are correlated both across firms and over time.

The basic structure of our model is similar to the "signal-jamming" model of Holmstrom (1982a), Fudenberg and Tirole (1986), and others. In these models, managers do not have private information about their characteristics, so they are not signaling models. Instead, managers learn along with the market about their types. Nevertheless, managers try to manipulate the market's assessments through unobservable actions. Similarly, in our model, firms are not privately informed about their inherent profitability, but try to influence the market's assessments through their unobservable product-market strategies.

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<sup>1</sup> The equivalence can also break down if the firm is partly debt-financed. In this case, shareholders receive the residual cash flows after payments to creditors. Thus, when cash flows are uncertain, managers who maximize share value care less about cash flows in those states of nature in which bondholders receive all the cash flows and shareholders receive none. By contrast, managers who maximize total firm value do not care how these cash flows are divided. Jensen and Meckling (1976) show that neglecting bondholders can lead to overinvestment relative to profit maximization; Myers (1977) demonstrated that this can also lead to underinvestment.

The stock market tries to infer a firm's costs and demand (and hence future profitability) based on the firm's realized profits and those of its rivals. Because cost and demand conditions are serially correlated, when a firm has high profits it conveys good news about the firm's future profitability. Not surprisingly, abnormally high profits therefore raise the firm's stock price. The main issue in our analysis is how the profits of a firm's rivals affect the firm's own stock price. There are two effects acting in opposite directions. First, when a rival's profits are relatively high, it suggests that the firm's own costs are high (or firm-specific product demand low) relative to its rivals. In this case, a firm's profits may be high in an absolute sense but, given its poor relative performance, these profits are likely to be temporary. This type of inference tends to depress the firm's stock price. There is a second, countervailing effect: when rivals' profits are relatively high, it suggests that the industry as a whole has low costs (or high demand). Here, better performance by rivals tends to raise the firm's stock price.

Our results depend on which of these competing effects is stronger. Suppose first that the former effect is more important: reductions in rivals' profits raise a firm's stock price. Firms then become more aggressive in the product market. In the context of our Cournot model it means that firms will produce more output than they would if they were pure profit maximizers. To see this, suppose that a firm's production decisions were the same as those in the standard Cournot model. Given that the firm is maximizing its profits, a small increase in the firm's output reduces its expected profits to the second order, but decreases its rivals' expected profits to the first order by lowering the product-market price. Thus, raising output above the Cournot level increases shareholder value, by raising the current stock price.

By contrast, suppose that the second of the two effects is stronger: investors view rivals' low profits mainly as indications of low industry-wide profitability. Then, firms have an incentive to act less aggressively than in the Cournot equilibrium. Each firm is willing to reduce its profits slightly to increase its rivals' profits, raise the stock market's assessment of industry profitability, and thereby increase its own stock price.

These results have implications for corporate financing behavior. Suppose, once again, that when a rival's profits are high it leads stock-market investors to value the firm less. Consider a firm with ample cash to finance investment. Since it is unlikely to issue equity in future periods, it is less concerned with its future stock price. As a result, the firm competes less aggressively in the product market. Rivals will then take advantage of this by competing more aggressively. Thus, excess cash works against firms in the product market; they lose market share to their leaner rivals and their profits are lower.

To overcome this problem, firms can try to gain competitive advantage by paying out free cash flows, thereby committing to return to the capital market for further financing. It is optimal for firms to pay high dividends, repurchase stock, or issue debt to commit to compete more aggressively. Although individually optimal, it is collectively inefficient for the industry. It means that all firms compete more aggressively, reducing industry profits. These implications for the choice of financial structure depend on which of the two effects dominates. Suppose instead that when rivals' profits are high, the firm's own stock price increases. Then, firms with ample cash are relatively more aggressive in the product market. This follows because firms that need to raise money in the capital market will actually try to boost their rivals' profits to increase their own stock price. In this case, cash distributions lead to a competitive disadvantage; they lower profits by inducing firms to compete less aggressively. Thus, in equilibrium, firms choose to maintain cash reserves.

This article has four sections following this one. In Section 1, we describe the model and present the conditions under which share-value maximizing firms compete more or less aggressively than profit-maximizing firms. In Section 2, we consider the implications of these product-market effects for financial policy along the lines discussed above. In Section 3, our results are put in the context of some related work and the empirical implications of the model are discussed. Section 4 contains concluding remarks.

## 1. The Model

We consider an industry with  $n$  firms producing a homogeneous product. The inverse demand function for this industry is  $p = P(Q)$ , where  $Q$  is the industry's output and  $p$  is the market price. Each firm  $i = 1, \dots, n$  produces output  $q_i$  at constant, but stochastic, marginal cost. The  $n$  firms choose simultaneously the quantity of output to sell as in the standard Cournot model. The equilibrium price is the one that clears the market given these quantities. The marginal cost of firm  $i$ ,  $c_i$ , is normally distributed with a mean of  $\bar{c} > 0$ .<sup>2</sup> We write  $c_i$  as the sum of  $\bar{c}$  and four normally distributed random variables whose means are zero:

$$c_i = \bar{c} + \theta_i + \nu_i + \eta + \epsilon.$$

The random variables  $\theta_i$ ,  $\nu_i$ ,  $\eta$ , and  $\epsilon$  have variances denoted by  $\sigma_\theta^2$ ,  $\sigma_\nu^2$ ,  $\sigma_\eta^2$ , and  $\sigma_\epsilon^2$ , respectively.

We use four random variables because the sources of cost uncer-

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<sup>2</sup> We could easily introduce firm-specific means, but it would not add much to the analysis.

tainty can be either firm-specific or industry-wide, transitory or permanent. Thus,  $\theta_i$  represents the firm-specific, permanent component of costs, and  $\nu_i$  the firm-specific, transitory component. It is best to think of  $\theta_i$  as measuring the efficiency of the firm's managers or the productivity of its durable assets. Analogously, the common component of costs can be written as the sum of a permanent shock,  $\eta$ , and a transitory shock,  $\epsilon$ . While we speak of  $\eta$  and  $\epsilon$  as common cost shocks, they can also be interpreted as negative demand shocks, with demand being given by  $P(Q) - \eta - \epsilon$ .<sup>3</sup>

It is worth noting that these random variables denote the components of costs that investors cannot readily observe. Costs for all firms in the industry might vary because of changes in labor or financing costs. However, since these costs are easy to observe, they should not be counted as part of the random component of  $c_i$ .

We make two key informational assumptions. The first is that outside investors observe only the level of profits. They observe neither the random cost variables nor the equilibrium prices and quantities. The assumption that outside investors are imperfectly informed about the random variables affecting the industry is plausible. Below we argue that these random variables are so difficult to isolate that even the firm's managers lack complete information about them.

What may be more controversial is our assumption that investors do not observe the equilibrium prices and quantities. In our model, all goods are identical, so there is a single market price that all consumers can presumably observe. Thus, it would appear unrealistic to assume that investors do not observe the price while consumers do. But, in a more realistic model, in which firms produce a variety of different products for different customers, the observation of a few prices conveys little information about the firm's chosen output. Rather than work with a complicated multiproduct model, we focus instead on a simple homogeneous goods model. Nonetheless, we retain the assumption that outsiders know nothing about prices and quantities.

Our second informational assumption is that firms cannot observe current marginal cost,  $c_i$ , when they choose their level of output.<sup>4</sup> Therefore, our model is not a signaling model; firms do not have private information that they signal through their actions. Since firms are uninformed about marginal costs, all firms must take the same

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<sup>3</sup> Instead of using four independent random variables, we could have assumed that costs are correlated across firms and over time. This would have led to an equivalent model in which the variance of costs is  $\sigma_\theta^2 + \sigma_\nu^2 + \sigma_\eta^2 + \sigma_\epsilon^2$ , the covariance of costs across firms is  $\sigma_\theta^2 + \sigma_\eta^2$ , the covariance of an individual firm's costs across time is  $\sigma_\nu^2 + \sigma_\epsilon^2$ , and the covariance of a firm's current costs with those of its rivals in the future is  $\sigma_\theta^2$ .

<sup>4</sup> We do not need to specify whether firms can observe their marginal costs after they are realized. We will see that in equilibrium, firms will be able to infer their marginal costs from their realized profits.

action in equilibrium. We make this informational assumption for two reasons.

First, it is reasonable to suppose that when firms choose the quantity to produce (which can also be thought of as their investment in production capacity) they do not know their marginal costs. This uncertainty could stem from partial ignorance of actual input costs, like the cost of labor or materials. However, this uncertainty is perhaps best thought of as uncertainty about the firm's underlying technical efficiency. For example, the firm's managers might learn only slowly about the productivity of the firm's assets or their own effectiveness at controlling costs.

A second reason for assuming that firms, like investors, are uninformed about  $c_i$  is that it simplifies the analysis without sacrificing realism. Unlike signaling models, where different "types" take different actions, in our model all types of firms take the same action. Nonetheless, our model shares an important feature with signaling models: firms spend resources to try to manipulate investors' beliefs about their characteristics; and, like "separating" equilibria in signaling models, firms are unable to fool the market in equilibrium.

In the standard Cournot model, firms maximize the present discounted value of profits. If, in our model, managers maximized their expected discounted value of profits, the Cournot outcome would obtain as well because shareholders and managers have the same information about costs. By contrast, we assume that managers care also about their stock price.

The stock price is simply the discounted value of profits expected by outside investors. If managers and shareholders had symmetric information about firms' outputs, managers' maximization of the current stock price would yield the same outcome as their maximization of discounted profits. This equivalence breaks down when, as in our model, outside investors cannot observe firms' outputs. Then, managers concerned with value maximization may take actions that reduce the present value of profits as long as these actions enhance investor perceptions of future profits.

Let  $\pi_i$  denote firm  $i$ 's first period profits and  $\pi_i^2$  the present discounted value of profits from the second period onward. We assume for simplicity that firms are risk-neutral and that their discount rate is zero. Thus, if firm  $i$  maximized the present discounted value of profits it would maximize

$$E(\pi_i + \pi_i^2),$$

where the expectation operator,  $E$ , refers to the firm's expectations over  $\eta$ ,  $\epsilon$ , and the  $n$  realizations of  $\theta$  and  $\nu$ . Because we have abstracted from investment, firm  $i$ 's current decisions have no effect on profits

in future periods. Therefore, maximization of the present discounted value of profits entails maximizing just  $\pi_i$ .

Following Miller and Rock (1985) and Stein (1989), we assume that managers also care about the firm's stock price at the end of the first period,  $p_i$ . Formally, we assume that managers maximize a weighted average of (i) the present discounted value of profits and (ii) the income of a shareholder who sells his shares at the end of the first period. We call this weighted average "shareholder value" because it equals the initial expected utility of a risk-neutral shareholder who is uncertain whether he will sell his shares in the future. Assuming that first-period profits are immediately distributed to all shareholders, those who sell their shares earn  $\pi_i + p_i$ . Those who do not sell receive  $\pi_i + \pi_i^?$ . Thus, we write shareholder value,  $V_i$ , as

$$V_i = E[\alpha(\pi_i + p_i) + (1 - \alpha)(\pi_i + \pi_i^?)], \quad (1)$$

where the positive constant  $\alpha$  can be thought of as either the fraction of shareholders who sell their shares for liquidity reasons or the probability that there will be a takeover at the price  $p_i$ . The parameter  $\alpha$  could also be related to the possibility of future equity issues. We return to this interpretation in Section 4. Note that in our setting a firm that maximizes (1) in the first period can have no effect on  $\pi_i^?$ . Thus, the relevant expression to maximize is  $E[\pi_i + \alpha p_i]$ .

The stock price  $p_i$  represents investors' expectations at the end of the first period of  $\pi_i^?$ . One way of modeling these future profits would be to assume that the competitive interaction among these firms is carried out several times. We avoid this assumption because it introduces other effects that are not the focus of our article. As Riordan (1985) shows in a model with repeated rounds of competition, firms have an incentive to influence their rivals' perceptions of their productivity. Firms want to convince others that they have low costs to induce them to produce less. This leads firms to compete more aggressively. However, we wish to abstract from this effect to focus on those that are mediated through financial markets.

Thus, we assume that there is only one oligopolistic interaction while the stock price nonetheless depends on investor perceptions about the permanent component of costs,  $\theta_i + \eta$ . What we have in mind is that the firms have available to them projects in the later periods whose expected return is related to this cost. Firms with lower values of  $\theta_i$  are better managed or have more productive physical assets, so the return they can hope for on other projects is higher. It is in this sense that  $\theta_i$  is a permanent shock to costs. Similarly, firms in low-cost industries will have better projects available to them.

For notational simplicity, we define  $\beta_i \equiv \theta_i + \eta$  and  $\hat{\beta}_i$  as the stock market's expectation of these costs. The stock price then equals



$g(\hat{\beta}_i)$ , which is decreasing in  $\hat{\beta}_i$  since firms with greater costs are worth less. In the next section, we derive this function from more fundamental features of the model, but now we treat it as fixed.

Given this assumption, firms maximize

$$E[\pi_i + \alpha g(\hat{\beta}_i)]. \tag{2}$$

The next step is to calculate  $\hat{\beta}_i$  given any realization of  $\pi_k$  for the  $k = 1, \dots, n$  firms. While investors cannot observe the outputs of the  $n$  firms, they can make rational conjectures about the outputs chosen in equilibrium. Let  $q_k^*$  be the conjectured equilibrium outputs of the  $n$  firms. Of course, a requirement of the equilibrium is that these conjectures are correct. Thus, investors recognize that profits are determined by the following equation:

$$\pi_k = [P(Q^*) - (\bar{c} + \theta_k + \nu_k + \eta + \epsilon)]q_k^*, \tag{3}$$

where  $Q^* = \sum_k q_k^*$ . From Equation (3), investors can infer the realization of  $\theta_k + \nu_k + \eta + \epsilon \equiv z_k$ . Given the conjectured output of the  $n$  firms,

$$z_k \equiv \theta_k + \nu_k + \eta + \epsilon = P(Q^*) - \pi_k/q_k^*. \tag{4}$$

From each  $\pi_k$ , investors derive  $z_k$ . They then update their prior about  $\hat{\beta}_i$  in Bayesian fashion. Suppose this prior is also normal with mean zero. Calculating this conditional expectation is equivalent to regressing  $\beta_i$  ( $\equiv \theta_i + \eta$ ) on  $z_i$  and the  $n - 1$  values of  $z_k$ . Standard arguments then imply that  $\beta_i$  is given by

$$\hat{\beta}_i = \phi z_i + \psi \sum_{k \neq i} z_k, \tag{5}$$

where

$$\phi \equiv \frac{(\sigma_\theta^2 + \sigma_\nu^2)(\sigma_\theta^2 + \sigma_\eta^2) + (n - 1)\sigma_\theta^2(\sigma_\eta^2 + \sigma_\epsilon^2)}{(\sigma_\theta^2 + \sigma_\nu^2)[n(\sigma_\eta^2 + \sigma_\epsilon^2) + \sigma_\theta^2 + \sigma_\nu^2]},$$

$$\psi \equiv \frac{\sigma_\nu^2\sigma_\eta^2 - \sigma_\epsilon^2\sigma_\theta^2}{(\sigma_\theta^2 + \sigma_\nu^2)[n(\sigma_\eta^2 + \sigma_\epsilon^2) + \sigma_\theta^2 + \sigma_\nu^2]}.$$

There are two important features of this updating rule. First,  $\hat{\beta}_i$  is increasing in  $z_i$  and thus decreasing in  $\pi_i$ . Because costs are positively serially correlated, higher profit realizations for firm  $i$  lead investors to believe that the firm's future profits are likely to be high as well. Second, the effect of  $z_k$  on  $\hat{\beta}_i$  is, in general, ambiguous. If  $\sigma_\nu^2\sigma_\eta^2$  is

greater than  $\sigma_\epsilon^2\sigma_\theta^2$ ,  $\psi$  is positive and higher values of  $z_k$  (lower  $\pi_k$ ) lead investors to believe that firm  $i$  has large permanent costs. In this case, for a given value for its own realized profits, firm  $i$ 's stock price rises when its rivals report relatively large profits. If  $\sigma_\nu^2\sigma_\eta^2$  is less than  $\sigma_\epsilon^2\sigma_\theta^2$ , higher values of  $z_k$  lead investors to lower their expectations about firm  $i$ 's permanent costs. Thus, all else being equal, higher rivals' profits (lower  $z_k$ ) lead to a reduction in firm  $i$ 's stock price.

The condition determining the sign of  $\psi$  is worth exploring in more detail because the sign of  $\psi$  has an important effect on our results. Suppose that  $\sigma_\eta^2 = 0$ , so that investors care only about predicting  $\theta_i$ . When a rival's profits are high ( $z_k$  low), relative to the profits of firm  $i$ , investors infer that the only common component of firms' costs,  $\epsilon$ , is low. This means that, for a given  $\pi_i$ ,  $\theta_i$  must be high. As a result, the assessment of the future profitability of firm  $i$  depends negatively on the realized profits of the other firms;  $\psi$  is negative. This case captures the simple notion that relative performance is a valuable tool in assessing ability when there are common shocks to performance. Similar effects arise in the tournaments literature [Lazear and Rosen (1981), Holmstrom (1982b), and Nalebuff and Stiglitz (1983)]. There, too, relative performance provides information about the actions of individual agents because performance is affected by a transitory shock common in all agents.

By contrast, suppose  $\sigma_\theta^2 = 0$ , so that investors care only about predicting  $\eta$ . High profits by rivals lead investors to revise downward their estimates of both common cost shocks  $\eta$  and  $\epsilon$ . This reduction in the perceived  $\eta$  represents an improvement in the assessment of firm  $i$ 's costs. So, in this case, increases in competitors' profits raise the perceived future profitability of the company and  $\psi$  is positive.

However, note that for  $\psi$  to be positive, there must be some uncertainty about idiosyncratic, transitory costs,  $\nu$ . If not, any differences in profit realizations must stem from differences in  $\theta$ . A high value of a rival's profits is then an indication that  $\theta_i$  is large and  $\theta_k$  is small. Similarly, for  $\psi$  to be negative, there must be some uncertainty about the transitory common component of costs,  $\epsilon$ . If there is not, other firms' profits can only provide news about the permanent component of common costs.

Of course, if all four variances are positive, the sign of  $\psi$  is, in general, ambiguous. The sign can be written as a function of the signal-to-noise ratios of the common and idiosyncratic cost components. The higher is the signal-to-noise ratio of the common component,  $\sigma_\eta^2/\sigma_\epsilon^2$ , the more useful is the joint movement of profits as an indicator of  $\eta$ . Similarly, the higher is the signal-to-noise ratio of the idiosyncratic component, the more useful is the difference in profits as a gauge of  $\theta$ . Thus, it is not surprising that when the signal-to-noise

ratio of the common component,  $\sigma_{\eta}^2/\sigma_{\epsilon}^2$ , is smaller than the signal-to-noise ratio for the idiosyncratic component,  $\sigma_{\theta}^2/\sigma_{\nu}^2$ ,  $\psi$  is negative. If the inequality is reversed,  $\psi$  is positive. In general, the larger is the signal-to-noise ratio of the common component relative to the idiosyncratic component, the larger is  $\psi$ .

In practice, there is probably considerable *unobservable* variability in  $\theta$ , since  $\theta$  is best thought of as managerial ability or the productivity of a firm's durable assets. In contrast, the idiosyncratic transitory component of costs is likely to be driven by temporary changes in firm-specific factor prices (e.g., regional labor cost increases, bad weather, high real-estate rental rates). Each of these cost changes is to some extent observable, so that it contributes little to  $\nu$ . This suggests that the variance of  $\nu$  is small. If this a priori reasoning is correct,  $\psi$  is likely to be negative.

A different type of evidence on  $\psi$  comes from the studies of Foster (1981) and Clinch and Sinclair (1987). Foster (1981) shows that, on average, when the stock market responds favorably to a firm's earnings announcement, the stock prices of other firms in the industry tend to rise as well. One might be tempted to conclude that  $\psi$  is positive. This conclusion is premature because  $\psi$  measures the marginal effect on  $\hat{\beta}_i$  of other firms' profits, *given that firm  $i$ 's profits are already known*. Foster's study, however, averages the stock-price effect on firms that have already announced their earnings with those that have not.

By contrast, Clinch and Sinclair (1987) carefully distinguish the effect of a firm's earnings announcement on the stock price of firms that have already announced their earnings from the effect on the stock price of firms that have not yet announced their earnings. They find that, on average, earnings reports that increase a firm's stock price also increase the stock prices of those firms in the industry *that have already made earnings announcements*. This suggests that  $\psi$  is positive.

Unfortunately, Clinch and Sinclair suggest that their results may be due to two institutional features of their Australian data, which have little to do with our analysis. Australian firms release earnings announcements only semiannually, so that announcements by different firms in an industry can be spread over several weeks. Although these announcements cover the same fiscal period, news may have come out that changes the interpretation of these numbers. In addition, the announcements are accompanied by broad reports of the industry outlook. Clinch and Sinclair (1987) suggest that the additional information provided by these reports might explain the stock-price reactions of the firms that have already announced their earnings.

## 2. Equilibrium

This section analyzes product-market equilibrium in light of the updating rules discussed above. We study Nash equilibria, in which firms choose output, taking as given all other firms' output choices. Firms also take as given the updating rule (5) that investors use. Finally, investors take as given the strategies of the  $n$  firms. Of course, in equilibrium, everyone is at an optimum given the others' strategies, and the conjectured strategies are the chosen ones.

There are two effects that a firm considers when it chooses output. First, output directly affects profits; second, it alters the market's assessment of  $\beta_i$  and hence determines the firm's stock price. This latter effect arises because output affects the profits of all firms, and hence affects  $z_k$  for all firms.

We now determine the effects on  $\hat{\beta}_i$  of an increase in output for a given realization of  $\theta_i, \nu_i, \eta$ , and  $\epsilon$ . To do this, we differentiate (5) with respect to  $q_i$ :

$$\left. \frac{d\hat{\beta}_i}{dq_i} \right|_{\theta_i, \nu_i, \eta, \epsilon} = \frac{-\phi\pi'_i(\theta_i, \nu_i, \eta, \epsilon)}{q_i^*} - \psi \sum_{k \neq i} P'(Q^*), \quad (6)$$

where

$$\pi'_i(\theta_i, \nu_i, \eta, \epsilon) = [P(Q^*) - \bar{c} - \theta_i - \nu_i - \eta - \epsilon] + P'(Q^*)q_i$$

is the derivative of profits of firm  $i$  with respect to its output for a particular realization of the random variables.

Note that we take  $q_k^* = 1, \dots, n$  as given when determining the effect of an increase of  $q_i$  on all  $\pi_k$  and hence  $z_k$ . This is because  $q_k^*$  is the market's conjecture of the chosen output, not the output itself.

The first term on the right-hand side of (6) reflects the effect of  $q_i$  on  $z_i$ . It lowers the market's assessment of  $\beta_i$  if and only if expected profits are increasing in output. The second term captures the effect of  $q_i$  on  $\hat{\beta}_i$  through its effect on the profits of the  $(n - 1)$  other firms. Since an increase in  $q_i$  lowers the product-market price, it lowers the profits of all other firms. Thus, if  $\psi$  is negative, increasing  $q_i$  lowers  $\hat{\beta}_i$ . By contrast, if  $\psi$  is positive, an increase in  $q_i$  increases  $\hat{\beta}_i$ . We are now ready to derive the first-order condition for the firm's choice of output. This will give us each firm's reaction function—its optimal choice of output given all other firms' output choices. Differentiating (2) with respect to  $q_i$  and equating this expression to zero yields

$$E \left[ \left[ 1 - \frac{\alpha\phi g'(\hat{\beta}_i)}{q_i^*} \right] \pi'_i \right] + \alpha\psi E[g'(\hat{\beta}_i)] \sum_{k \neq i} P'(Q^*) = 0. \quad (7)$$

The standard Cournot condition is a special case of Equation (7). We first discuss this case to serve as a benchmark against which to compare the more general case. When  $\alpha = 0$ , firms maximize current profit; they place no weight on the second-period stock price. Thus, all the terms with  $\alpha$  drop out and Equation (7) simply states that the firm sets the expected marginal profitability of output changes equal to zero: this is the stochastic version of the familiar Cournot condition. This condition is also optimal when investors are perfectly informed about  $\beta_j$ , even if  $\alpha > 0$ . In that case,  $\hat{\beta}_i$  cannot be affected by the firm's output choice, so that all terms with  $g'$  drop out.

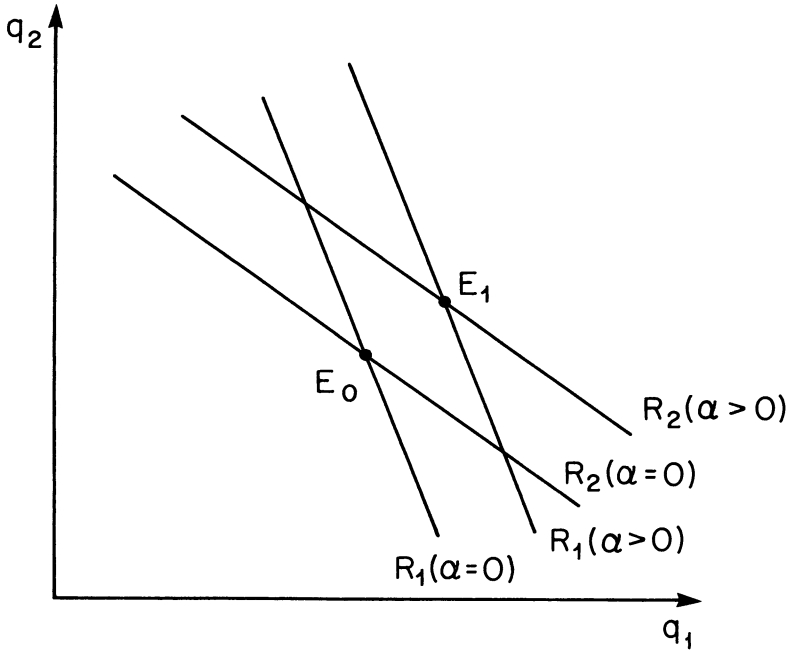
Figure 1 shows the reaction curves of the two firms in a duopoly. The two lines labeled  $R_i(\alpha = 0)$  give the optimal reaction of firm  $i$  to the output of firm  $j$  when firms maximize current profit ( $\alpha = 0$ ). As is standard, we assume that the Cournot reaction curves slope downward.<sup>5</sup> That is, an increase in rivals' conjectured output reduces the amount that an individual firm wishes to produce. The Nash equilibrium  $E_0$  obtains at the intersection of the two curves: at that point neither firm has an incentive to change its output given the other's output choice.

Equation (7) shows that the combination of share-value maximization and imperfect information has two effects on equilibrium. The first (and, in our context, less interesting) effect is that the firm weighs marginal profitability of quantity increases by  $1 - kg'$ , where  $k$  is a positive constant. If  $g'$  depends on  $\hat{\beta}_j$ , these weights on profits affect the firm's output decision. For example, suppose that  $g$  is sensitive to changes in  $\hat{\beta}_i$ , only for high values of  $\hat{\beta}_i$  (i.e., when the firm's profits are low). Then the firm is most concerned with increasing its profits in the states when  $\hat{\beta}_i$  is high. However, in these states the firm's current costs are high, and hence the marginal profitability of output increases is negative. This leads firms to produce less than the Cournot level of output. If, by contrast,  $g'$  is only sensitive to changes in  $\hat{\beta}_i$  for low values of  $\hat{\beta}_i$ , the opposite forces prevail and firms tend to produce more than the Cournot level.

This effect is similar to the effect of debt finance under *symmetric* information studied by Brander and Lewis (1986). Assuming that the value of equity is zero when firms cannot fully meet their debt obligations, share-value-maximizing managers place no weight on small profit realizations. Formally, this is similar to assuming that  $g$  is insensitive to changes in  $\hat{\beta}_i$  when  $\hat{\beta}_i$  is large. This implies that, even without asymmetric information, shareholder-maximizing firms produce more

<sup>5</sup> Provided the second-order condition is met, the reaction curves slope downward if the derivative of (7), with respect to rivals' outputs, is negative. This will be the case if

$$P'(Q^*) + P''(Q^*)q_i^* \leq 0.$$



**Figure 1**  
**Product-market equilibrium for  $\psi < 0$ : The cases  $\alpha = 0$  and  $\alpha > 0$**   
 $R_i(\alpha = 0)$  denotes the reaction function of firm  $i$  when  $\alpha$  equals zero for  $i = 1, 2$ , whereas  $R_i(\alpha > 0)$  denotes the reaction function when  $\alpha$  is positive.

output than the standard Cournot level. We wish to abstract from the effects analyzed by Brander and Lewis because, with equity financing, there is no a priori reason to expect  $g'$  to be particularly large for either high or low realizations of  $\hat{\beta}_i$ . Therefore, we assume for the moment that  $g'$  is a negative constant. Also, since the effect of non-constant  $g'$  would arise for a monopolist as well, we ignore it to focus on the competitive effects of share-value maximization. In the next section, however, we derive  $g'$  from more fundamental determinants of firm profitability.

The second—and, in our context, more interesting—effect of imperfect information and share-value maximization is apparent from the second term in (7). If  $\psi$  is negative, this term is positive [recalling that both  $g'$  and  $P'(Q^*)$  are negative]. This means that, when  $g'$  is constant, at an optimum, the expected value of  $\pi'$  is negative. Thus, holding fixed its competitors' outputs, each firm produces more output than the level that maximizes profits. It does so because small increases in output have no effect on its own profits. However, the increase in output lowers rivals' profits by lowering the market price. This lowers the market's assessment of the firm's permanent costs,  $\beta_i$ ,

and raises its stock price. Exactly the opposite is true if  $\psi$  is positive: firms produce less than the Cournot level because small reductions in output have only a second-order effect on the firm's own profits, but boost their rivals' profits. This lowers the market's assessment of  $\beta_i$  and raises firm  $i$ 's stock price.

When  $\psi$  is negative, the maximization of share value shifts out each firm's reaction curves; given the output of rival firms, each firm produces more output. Provided the reaction curves slope downward, this translates into an increase in the equilibrium output of all firms. One can indeed show that, if  $\psi$  is negative and the reaction curves slope downward in the standard Cournot case, they will slope downward here as well.<sup>6</sup>

We illustrate this graphically in Figure 1 for the duopoly case. As discussed above, the intersection  $E_0$  of the two lines labeled  $R_i(\alpha = 0)$  is the standard Cournot equilibrium. When  $\alpha$  is positive, both reaction curves shift out to  $R_i(\alpha > 0)$ . Equilibrium obtains at  $E_1$ , so that output increases. The opposite is true when  $\psi$  is positive: reaction curves shift in.

Several important features of this equilibrium are worth noting. First, since output is greater than the profit-maximizing equilibrium level if  $\psi$  is negative (and hence further away from the monopoly level), firms' profits are lower when they maximize shareholder value. By contrast, profits are higher if  $\psi$  is positive.

Second, investors are not fooled in equilibrium. They correctly predict the equilibrium outputs and make rational inferences about  $\theta_i + \nu_i + \eta + \epsilon$ . Nonetheless, firms try to manipulate the market's beliefs through their output choices. In the end, they fool no one, but the market's expectations drive them toward this strategy.<sup>7</sup>

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<sup>6</sup> The derivative of (7) with respect to the output of other firms is

$$\left[ 1 - \frac{\alpha \phi g'(\hat{\beta}_i)}{q_i^*} \right] [P'(Q^*) + P''(Q^*)q_i] + \alpha \psi (n-1) g'(\hat{\beta}_i) P''(Q^*).$$

For the reaction curves to slope downward, this expression must be negative. In the usual case (which corresponds to  $\alpha$  equal to zero) the corresponding condition is that

$$[P'(Q^*) + P''(Q^*)q_i]$$

must be negative. For sufficiently low  $\psi$  (and certainly for negative  $\psi$ ), this condition implies the one stated above. For large  $\psi$ , this latter condition is weaker when  $\alpha$  is large and  $P''$  is strictly negative.

<sup>7</sup> In this sense, the model is similar to the labor-market model of Holmstrom (1982a). In his model, workers exert effort to influence the market's assessment of their abilities. Of course, in equilibrium they have no effect on the market's beliefs. But given the market's beliefs, a worker who reduced his effort would be viewed as less able. Workers might be better off if they could band together and reduce their effort, but noncooperative behavior makes this impossible. This equilibrium feature is also found in other contexts in papers by Riordan (1985) and Fudenberg and Tirole (1986).

This implies that the second-period stock price is the same regardless of whether firms maximize profits or shareholder value. However, if  $\psi$  is negative, the first-period stock price is lower since profits are lower: although firms set out to maximize shareholder value, shareholders are worse off than when firms maximize profits. However, note that because the firms' outputs are greater in this equilibrium than when firms maximize profits, prices are closer to expected marginal costs and social welfare is higher. Again, the opposite is true if  $\psi$  is positive: profits are higher, shareholders are better off, and social welfare is lower when firms maximize shareholder value.

### 3. Implications for Financial Policy

We argued above that firms care about their stock price because they may need to issue equity to finance investment. This section presents a more detailed analysis of the effect of equity issues on product-market equilibrium. We show that the prospect of issuing equity in the future can make firms more aggressive in the product market. Therefore, firms may wish to commit to an aggressive product-market strategy by increasing the importance of external, equity financing. They can do so by distributing cash flows in the form of dividends or stock repurchases.

To explore these ideas, we consider the following extension of our basic framework. Suppose that each firm has an investment project in the second period that requires  $I$  as an initial outlay. The return on the investment is inversely related to  $\beta_i$ , the firm's measure of cost efficiency. In particular, we assume that the cash flows from this project are  $Ae^{-b\beta_i}$ , where  $A, b > 0$ . This particular functional form simplifies the analysis because of the assumed normality of the shocks.

In the first period, each firm has  $C$  in cash, where  $I < C$ . If it wished, a firm could thus finance its project with internal funds. Firms must decide before choosing their output how much of  $C$  to distribute to shareholders. Define  $x_i$  as the payout to shareholders of firm  $i$ . This distribution is publicly observable to all investors and competing firms. For simplicity, we also assume that the firm distributes all of its first-period profits as a dividend.<sup>8</sup>

If a firm distributes  $x_i$  and  $I > (C - x_i)$ , it must raise  $I - (C - x_i)$  from the equity market to finance the investment. Firms that issue equity incur a fixed cost,  $F$ . The equity issue gives new investors a claim on a fraction  $\gamma_i$  of the firm's second-period cash flows. The fraction,  $\gamma_i$ , is set so that the new shareholders receive the appropriate

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<sup>8</sup> This assumption is unimportant given that a firm can, if it wishes, finance the project with its cash.



rate of return on their investment of  $I - (C - x_i)$ . As before, we set this rate of return equal to zero.

Summarizing, the timing of the model is as follows. First, managers distribute cash to shareholders. Then, all firms compete in the product market, distributing all of their profits to shareholders. Finally, firms issue equity to finance the second-period project, undertake the project, and distribute its cash flows as a liquidating dividend.

We begin by supposing that an individual firm plans to raise funds in the equity market. Investors who buy the new equity form expectations about its value based on the observations of all firms' profits. Thus, they demand a fraction,  $\gamma_i$ , of the cash flows such that<sup>9</sup>

$$\gamma_i AE(e^{-b\beta_i}) = I + F + x_i - C, \tag{8}$$

where the expectation is conditioned on the observations of all firms' profits.<sup>10</sup>

Let  $N(\beta_1, \dots, \beta_n, \nu_1, \dots, \nu_n, \epsilon)$  represent the multivariate normal distribution of the  $\beta_i$ 's,  $\nu_i$ 's, and  $\epsilon$  (with the distributions of the  $\theta_i$ 's and  $\eta$  subsumed in the distribution of the  $\beta$ 's). As before, investors observe all firms' profits and thus observe the set of variables  $z_1, \dots, z_n$ . Therefore, their conditional expectation of the firm's cash flows is

$$\begin{aligned} AE(e^{-b\beta_i}) &= A \int_{\nu_1, \dots, \nu_n, \epsilon} e^{-b\beta_i} \\ &\quad \cdot N(z_1 - \nu_1 - \epsilon, \dots, z_n - \nu_n - \epsilon, \nu_1, \dots, \nu_n, \epsilon) \\ &\quad \cdot d(\epsilon, \nu_1, \dots, \nu_n) \\ &= e^{-b\hat{\beta}_i + (b^2/2)\hat{\sigma}^2}, \end{aligned} \tag{9}$$

where  $\hat{\beta}_i$  and  $\hat{\sigma}^2$  are the conventional mean and the conditional variance of  $\beta$ , respectively.

Thus, given investors' beliefs,  $\hat{\beta}_i$ ,

$$\gamma_i = \frac{I + F + x_i - C}{Ae^{-b\hat{\beta}_i + (b^2/2)\hat{\sigma}^2}}. \tag{10}$$

It follows from (10) that if investors believe that  $\beta_i$  is low (and the returns on the second-period project are high), the firm must issue less equity to finance the investment. It is important to keep in mind that  $\gamma_i$  is a function of  $\hat{\beta}_i$ :  $\gamma_i = \gamma(\hat{\beta}_i)$ .

Firm  $i$ 's objective is to maximize shareholder value:

<sup>9</sup> Note that  $1 - \gamma_i$  plays the same role as  $\alpha g(\cdot)$  in the previous section.

<sup>10</sup> Even if firms distribute all their cash, the right-hand side of (8) equals at most  $(I + F)$ . As  $A$  goes to infinity, the probability that  $E(Ae^{-b\beta_i})$  is smaller than  $(I + F)$  (so that the project is not worth investing in) goes to zero. We assume that  $A$  is sufficiently large that we can neglect this possibility.

$$\begin{aligned}
 V_i = x_i + \int_{\beta_1, \dots, \beta_n, \nu_1, \dots, \nu_n, \epsilon} & \left[ [P(Q) - \beta_i - \nu_i - \epsilon] q_i \right. \\
 & \left. + (1 - \gamma_i) A e^{-b\beta_i} \right] \\
 & \cdot N(\beta_1, \dots, \beta_n, \nu_1, \dots, \nu_n, \epsilon). \tag{11}
 \end{aligned}$$

In the first stage of the game, each firm  $i$  simultaneously chooses an amount to distribute,  $x_i$ . Then, given these distributions, firms simultaneously choose outputs.

We solve the model first by determining the equilibrium of the product-market game given all firms' choices of  $x$ . To do so, we differentiate (11) with respect to  $q_i$ . Using (10), this gives

$$\begin{aligned}
 \frac{dV}{dq_i} = \int_{\beta_1, \dots, \beta_n, \nu_1, \dots, \nu_n, \epsilon} & \left[ P(Q^*) - \beta_i - \nu_i - \epsilon + P'(Q^*) q_i \right. \\
 & \left. - b \frac{\partial \hat{\beta}_i}{\partial q_i} \frac{I + F + x_i - C}{e^{-b\hat{\beta}_i + (b^2/2)\hat{\sigma}^2}} e^{-b\beta_i} \right] \\
 & \cdot N(\beta_1, \dots, \beta_n, \nu_1, \dots, \nu_n, \epsilon) = 0, \tag{12}
 \end{aligned}$$

where  $\partial \hat{\beta}_i / \partial q_i$  is the change in  $\hat{\beta}_i$  resulting from a change in  $q_i$ , holding fixed the realizations of the random variables. Note that this derivative does not depend on the realizations of the random variables.

Changing the variables of integration and using (9), this simplifies to

$$\begin{aligned}
 \int_{z_1, \dots, z_n} & \left[ [P(Q^*) - z_i + P'(Q^*) q_i] - b \frac{\partial \hat{\beta}_i}{\partial q_i} [I + F + x_i - C] \right] \\
 & \cdot N^m(z_1, \dots, z_n) = 0, \tag{13}
 \end{aligned}$$

where  $N^m(z_1, \dots, z_n)$  is the marginal distribution of  $(z_1, \dots, z_n)$ .

Finally, using Equation (5), Equation (13) becomes

$$\begin{aligned}
 \left[ 1 + \frac{b\phi(I + F + x_i - C)}{q_i^*} \right] & \left[ P(Q^*) - \bar{c} - P'(Q^*) q_i \right] \\
 + b\psi(I + F + x_i - C) & P'(Q^*) = 0. \tag{14}
 \end{aligned}$$

Therefore, firms set expected marginal profits from increased output,  $[P(Q^*) - \bar{c} - P'(Q^*) q_i]$ , equal to a number whose sign is the same as  $\psi$ 's. If  $\psi$  is negative, each firm produces more than the profit-maximizing level of output; whereas if  $\psi$  is positive, the opposite is true. This is just another version of the results derived in the previous section.

Next, we consider the firm's decision of how much cash,  $x_i$ , to distribute to shareholders in the first period, given that it will issue equity later. We show that, if  $\psi$  is negative, firms set  $x_i = C$ ; they distribute all their cash to shareholders. If  $\psi$  is positive, they have no incentive to distribute any cash.

To see this, suppose that firm  $i$  did not distribute all its cash:  $x_i < C$ . Consider a small increase in  $x_i$ . We first show that an increase in  $x_i$  shifts out the firm's reaction curve if  $\psi$  is negative, whereas it shifts it in if  $\psi$  is positive. Then we argue that outward shifts are profitable, whereas inward shifts are not. To analyze the effect of changes in  $x_i$  on the reaction curve of firm  $i$ , we differentiate (14) with respect to  $x_i$ . Given that the second-order condition is met,  $dq_i/dx_i$  (holding fixed all other firms' outputs) is positive if and only if the derivative of (14) with respect to  $x_i$  is positive. Differentiating (14), we have

$$\begin{aligned} \frac{d^2 V_i}{dq_i dx_i} &= \frac{b\phi}{q_i^*} [P(Q^*) - \bar{c} - P'(Q^*)q_i^*] + b\psi P'(Q^*) \\ &= - \frac{[P(Q^*) - \bar{c} - P'(Q^*)]q_i}{I + F + x_i - C}, \end{aligned} \tag{15}$$

where the second equality follows from (14).

In analyzing the effect of  $x_i$  on firm  $i$ 's reaction curve, we consider separately the cases of positive and negative  $\psi$ .

### 3.1 Positive $\psi$

Equation (14) implies that if  $\psi$  is positive,  $P(Q^*) - \bar{c} - P'(Q^*)q_i$  is positive and firms produce less than the Cournot level of output. This implies that the expression in (15) is negative. Holding the reaction curves of all other firms fixed, an increase in  $x_i$  shifts firm  $i$ 's reaction function toward the origin, lowering its equilibrium output, while raising the outputs of all other firms. The reduction in firm  $i$ 's output has only a second-order effect on its profits, whereas the increase in other firms' outputs lowers the equilibrium price and hence has a first-order negative effect on the profits of firm  $i$ .

In this case, the more firms care about their stock price, the less aggressively they compete in the product market. This implies that firms that distribute cash are put at a competitive disadvantage. Thus, firms retain cash to avoid the negative product-market effects of cash distributions and the fixed costs of issuing equity.<sup>11</sup> The implication is that when  $\psi$  is positive, firms retain all their cash and produce the

<sup>11</sup> The firm can actually distribute up to  $C - I$  without adversely affecting itself in the product market because it will still be able to finance second-period investment with internally generated funds.

Cournot level of output. This unfortunately appears inconsistent with the observations that firms do indeed distribute cash and that share prices respond favorably to these distributions.

### 3.2 Negative $\psi$

In this case, the expression in (15) is negative and firm  $i$ 's reaction function shifts out when it distributes cash. This distribution now raises firm  $i$ 's equilibrium output and reduces the outputs of its rivals. As before, the change in firm  $i$ 's output has only a second-order effect on its profits, but the fall in other firms' outputs *raises* the product-market price and hence raises firm  $i$ 's profits.

This means that, given other firms' cash distributions, each firm has an incentive to distribute all of its first-period cash. When  $\psi$  is negative, such distributions make the firm more aggressive. This, in turn, leads competitors to reduce their output, making the distribution of cash worthwhile. If the capital market rewards firms when their competitors do relatively poorly, cash distributions make the firm willing to sacrifice more of its current profits to tarnish its competitors' image. This aggressiveness leads the competitors to contract and, therefore, is profitable.

These contractions are more valuable the greater is the difference between price and marginal cost. Moreover, rivals reduce their output by more the greater is the effect of one's own output expansion on price. Thus, cash distributions are more valuable when this response is larger. If, instead, price equals marginal cost and the relevant demand curve for the firm has zero slope, (15) implies that firms have no incentive to distort their balance sheets.

Even when there are product-market advantages of distributing cash, firms may be reluctant to do so. Cash distributions imply that the firm is more prone to issue equity and thereby incur a fixed issuing cost,  $F$ . If  $F$  is quite large, no firm will wish to bear this cost despite the fact that it gains a product-market advantage; however, if  $F$  is sufficiently small, each firm will want to distribute all of its cash.

If  $F$  is relatively small for each firm, all firms will distribute cash. While such a policy is individually rational, it lowers all firms' product-market profits. Given that, in equilibrium, firms have no effect on second-period stock price, shareholder value (first-period stock price) is also lower. Note, however, that social welfare is higher in this equilibrium as firms compete more aggressively and prices move closer to expected marginal costs.<sup>12</sup>

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<sup>12</sup> This is strictly true for  $F = 0$ ; however, it is conceivable that if  $F > 0$ , the deadweight loss from issuing equity could outweigh the social welfare gain from greater competition in the product market.

Formally, this model is similar to many that analyze strategic interactions in the product market. For example, Spence (1977) and Dixit (1980) show that for competitive reasons there is an excessive incentive to invest in cost-reducing technologies. By lowering marginal costs, a firm's reaction curve shifts out, thus lowering the equilibrium output of rivals. This is analogous to the result for negative  $\psi$ : firms distribute cash, shifting out their reaction curves, and lowering rivals' outputs. Furthermore, as in our model, in the Spence–Dixit framework, if all firms follow this individually rational strategy, industry profits will be lower.

It is worth comparing the implications of our model when  $\psi$  is negative to those of Jensen's (1986) theory of "free cash flows." In Jensen's view, managers with control over corporate cash would rather invest the cash in negative present-value investments than distribute it to shareholders. Shareholders can curb this form of managerial slack—emphasis on growth over profitability—by forcing managers to distribute cash flows to them in the form of dividends, stock buybacks, or debt. In this way, investments must be financed externally, and thus must receive careful scrutiny from the capital market. In support of this view, Jensen cites numerous event studies showing that cash distributions and debt–equity exchanges are associated with increased share prices.<sup>13</sup>

Suppose that a single firm perceives that its cost,  $F$ , of raising funds in the capital market has fallen. Then, our model predicts that the firm will distribute cash. Indeed, cash distributions should naturally be perceived by investors as being due to reductions in  $F$ . Therefore, these changes in financial structure ought to raise share values and profits. This has nothing to do with reductions in managerial slack: in our model, there are no agency problems between shareholders and managers. Rather, cash distributions induce firms to compete more aggressively, behavior which may look like a reduction in managerial slack. This implies that while the firm's own share price should rise after a cash distribution, the share prices of other firms in the industry should fall.

There are other important differences between the models. First, our model predicts that if there is a positive share-price reaction to a firm's cash distribution, the firm will be more likely to return to the capital market to finance future investment. In Jensen's model, firms distribute cash to commit not to invest. Therefore, they are less likely to seek further funding from the capital market; positive share-price

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<sup>13</sup> One problem with this interpretation is that he does not explain what leads to the cash distributions themselves. In this respect, signaling models of financial structure where dividends, stock buybacks, and debt–equity exchanges are interpreted as positive signals are more complete. In those models, certain well-specified exogenous events lead to cash distributions.

responses to cash distributions should be associated with less frequent use of the capital market.

Second, there is a subtle distinction between unilateral actions that increase an individual firm's profits and its share price, and industry-wide actions that have the opposite effect. In our model, if  $F$  falls for all firms so that they all distribute cash, each firm's profits and share price fall. In contrast, such interactions are absent in Jensen's model.

Finally, in our model, cash distributions are associated with increases in investment and sales. This unilateral investment and sales increase lead to greater profits and share prices. By contrast, in Jensen's framework, cash distributions result in *less* investment and sales, and this reduction raises profits and share price by eliminating unnecessary capital expenditures and growth.

Unfortunately, there is no direct evidence on the effects of cash distributions on investment. However, the recent wave of management buyouts (MBOs) provides useful information about the validity of the ideas presented above. In the typical MBO, the firm is purchased for a large premium, financed mainly by issuing new debt. Although MBOs typically involve taking the firm private, successful MBOs generally end with a new public offering of the company's shares. Indeed, the often-stated objective of an MBO is to reorganize the company so that it can be taken public once again.

In this way, an MBO makes a company's fortunes more dependent on the stock market's perception of its profitability. Our theory thus predicts that one of the benefits of an MBO is that it leads competitors to retrench (or perhaps to respond with an MBO of their own).

Kaplan's (1988) study of MBOs provides some evidence that bears on these issues. He finds that, after undergoing a buyout, firms had lower growth in sales and capital expenditures (controlling for industry trends), although the differences in the pre- and postbuyout medians were not statistically significant. This is the opposite of what our theory predicts.<sup>14</sup>

The results are quite different, however, if one focuses only on those buyout firms that went back to the capital market either to issue more debt or to resell themselves to the public or to another firm. These firms had *higher* growth in sales and capital expenditures, although neither difference in the medians was statistically significant. These are precisely the MBO firms that we would expect to

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<sup>14</sup> One should keep in mind two caveats in interpreting this result. First, the buyout firms were already underperforming their industry rivals before the buyout. In the year after the buyout, capital expenditures actually rose by 0.31 percent. Second, buyout firms are more likely to sell divisions than other companies in their industry. This tends to depress sales and capital expenditures even if the companies become more aggressive in the lines of business in which they remain. (Note that our theory does not explain this fact.)

outperform their rivals because they are more likely to be concerned with the capital market's perception of their value. In contrast, firms that did not undergo a subsequent sale exhibit lower growth in sales and capital expenditure.<sup>15</sup>

Our theory (with negative  $\psi$ ) also predicts that there should be a share price rise at the announcement of an MBO and that the share price of other firms in the industry should fall. The former prediction is obviously true, whereas there is no evidence on the latter. Of course, the actual magnitude of stock-price increases accompanying MBOs is so large that it is unlikely to be due exclusively to this phenomenon. MBOs almost certainly have other advantages.<sup>16</sup> If we add these other benefits to our model, its predictions concerning the share prices of competitors are weakened. The reason is that a successful MBO by a firm in the industry may convey information about the ease with which MBOs (and their attendant efficiencies) can be carried out by its competitors. Therefore, even when one of the benefits is the retrenchment of competitors, the price of competitors' shares may increase if investors are led to revise upward their estimate of the profitability of MBOs in the industry.

#### **4. Conclusions**

In this article, we have analyzed a model in which a firm's output choice depends on its capital structure. As a result, firms alter their capital structure to affect their competitive position in the product market. However, this model could be extended to analyze other firm activities that affect a firm's competitive position.

Consider, in particular, investment activities that affect a firm's market share, such as advertising or quality improvements. Scherer (1988) and others have argued that U.S. firms are more concerned with short-term results than their Japanese counterparts and that, as a consequence, they carry out fewer of these investments.<sup>17</sup> This concern for short-term results is documented in Abegglen and Stalk (1985), who report that Japanese managers list share-price maximization as last on a list of 10 objectives, whereas American managers list it second.

Our model points to a weakness in the link between short investor

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<sup>15</sup> An alternative interpretation is that only successful firms return to the capital market, and that they also expand capacity and sales more rapidly than unsuccessful firms. While this alternative interpretation is plausible, we note that it runs counter to Jensen's free-cash-flow theory, which posits that successful companies are the ones that reduce their capital expenditure the most.

<sup>16</sup> Among the advantages mentioned in the literature are tax reductions, bondholder expropriations, and increased efficiency of investment plans. See Kaplan (1988) and Shleifer and Vishny (1988) for a review of the reasons firms undertake MBOs.

<sup>17</sup> Stein (1989) and Narayanan (1985) present models in which this seemingly myopic project choice exists in equilibrium.

horizons and lack of aggressiveness in product markets. It is true that the low initial profits that accompany investment in market share are a negative signal of a firm's profitability. As a result, firms concerned with the value of their shares might avoid those projects whose short-term payoffs are low.

However, this only focuses on part of the story by ignoring the other firms in the market. Aggressive product-market strategies may lower profits, but some of these strategies may also lower the current profits of the other firms in the industry. Increases in advertising or quality may increase revenues by less than they increase costs but, at the same time, they may reduce rivals' current revenues. The positive reputational effect of lowering rivals' profits can outweigh the negative reputational effect of lowering one's own profits.

More generally, our article points to the need for analyzing imperfect competition together with corporate financial structure. This paper is not the first to take this approach. We have already mentioned Brander and Lewis (1986) and its formal connection to our model. Bhattacharya and Ritter (1983), Titman (1984), Allen (1986), Gertner, Gibbons, and Scharfstein (1988), Maksimovic (1988), Rotemberg (1984, 1988), and Bolton and Scharfstein (1990) also analyze the interaction between the product and capital markets. This last paper is most relevant to our work. In their framework, creditors prevent managers from diverting resources to themselves by threatening to cut off funding if the firm's performance is poor. This optimally designed "shallow pocket" reduces agency problems, but makes firms vulnerable to aggressive product-market competition. Rivals understand that predatory actions, which reduce the firm's profits, are likely to be followed by the firm's exit. The optimal financial structure balances the agency and product-market effects.

This result accords well with one version of our model, but conflicts with the other. If  $\psi$  is positive, firms are reluctant to distribute cash and commit to return to the capital market, because they would then compete less aggressively in the product market and rivals would compete more aggressively. Likewise in the Bolton–Scharfstein model, the commitment to return to the capital market for further financing makes the firm more vulnerable in the product market by inducing rivals to compete more aggressively. This conflicts with the version of our model in which  $\psi$  is negative and firms commit to return to the capital market because it makes them more aggressive. Our view is that both of these latter effects can be at work, but that for most firms only one of these effects is important. Cash-poor firms, for whom exit is relatively likely, will be unwilling to distribute needed cash for fear of inducing predatory behavior by rivals. More liquid firms, which are less vulnerable to predatory behavior, may be more willing



to distribute cash as a way of committing to compete more aggressively. More generally, the two theories suggest that there are product-market costs and benefits of distributing cash.

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