

# EFFICIENT CAPITAL MARKETS, INEFFICIENT FIRMS: A MODEL OF MYOPIC CORPORATE BEHAVIOR\*

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This paper develops a model of inefficient managerial behavior in the face of a rational stock market. In an effort to mislead the market about their firms' worth, managers forsake good investments so as to boost current earnings. In equilibrium the market is efficient and is not fooled: it correctly conjectures that there will be earnings inflation, and adjusts for this in making inferences. Nonetheless, managers, who take the market's conjectures as fixed, continue to behave myopically. The model is useful in assessing evidence that has been presented in the "myopia" debate. It also yields some novel implications regarding firm structure and the limits of intergation.

## I. INTRODUCTION

Does the desire to achieve a high stock price induce corporate managers to behave myopically, inflating current earnings at the expense of longer term benefits? Although managers themselves, as well as policymakers and members of the media, have voiced concern over this issue, many academic economists dismiss these worries as unfounded. The academic argument is based on the tenet of efficient markets: since it is unlikely that the market can be systematically fooled by inflated earnings, managers will only lower stock prices by undertaking actions that are not in the best long-run interests of their companies. Hence, managers who are concerned with high stock prices will not behave myopically.

Jensen [1986, p. 11] espouses this point of view, arguing that managerial myopia will only be a problem if managers *do not care enough* about stock prices:

Sometimes it (myopic behavior) occurs when managers hold little stock in their companies and are compensated in ways that motivate them to take actions that increase accounting earnings rather than the value of the firm. It also occurs when managers make mistakes because they do not understand the forces that determine stock values.

This paper disputes Jensen's contention, showing that even a fully efficient market can lead managers who care about stock prices to behave myopically. Indeed, the more managers are concerned about current share prices, the worse the problem becomes.

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The formal model used to make this point is a "signal-jamming" model, similar to ones employed in other contexts by Holmstrom [1982] and Fudenberg and Tirole [1986].<sup>1</sup> The basic idea is this: the stock market uses earnings to make a rational forecast of firm value—higher earnings today will be correlated with higher earnings in the future. Knowing this, managers will attempt to manipulate stockholders' signals, pumping up earnings to raise forecasted value. In equilibrium the market is *not fooled* by this jamming: it correctly conjectures that there will be a certain amount of earnings inflation, and takes this into account in making its predictions.

In spite of being unable to fool the market, managers are "trapped" into behaving myopically. The situation is analogous to the prisoner's dilemma. The preferred cooperative equilibrium would involve no myopia on the part of managers, and no conjecture of myopia (and hence no discounting of inflated earnings) by the stock market. Unfortunately, this cannot be sustained as a Nash equilibrium. If the market conjectures no myopia, managers will have an incentive to fool it by boosting current earnings.

Section II presents the formal model, and derives the signal-jamming equilibrium. Section III discusses several of the model's implications and compares it to other related work. Section IV offers concluding comments.

## II. THE MODEL

This section develops a steady-state learning model, in which the firm's value evolves gradually over time, and in which earnings can provide a clue as to this value. In the absence of any myopic behavior by managers, the firm's "natural" earnings in period  $t$ ,  $e_t^n$ , are given by

$$(1) \quad e_t^n = z_t + v_t.$$

Natural earnings consist of a "permanent" component  $z_t$  and a "transitory" component  $v_t$ . The  $z_t$ 's follow a random walk:  $z_t = z_{t-1} + u_t$ , where the  $u_t$ 's are a sequence of independent mean zero normal variates with variance equal to  $\sigma_u^2$ . The  $v_t$ 's, in contrast, are independent from period to period, also normal, with mean zero and

1. Another paper that uses a similar methodology is Lundberg and Startz [1983]. Like Holmstrom [1982] they address a problem in the labor market.

variance  $\sigma_v^2$ . Neither  $z_t$  nor  $v_t$  is ever directly observed by the firm's management or by outsiders in the marketplace.<sup>2</sup>

Earnings are publicly observable. However, the earnings that the market sees are not necessarily equal to the natural earnings  $e_t^n$ . This is because in any period  $t$  management can generate additional current income by "borrowing" against next period's earnings at an unfavorable implicit rate of interest. Specifically, if this borrowing is denoted by  $b_t$ , the observed earnings  $e_t$  are given by

$$(2) \quad e_t = e_t^n + b_t - c(b_{t-1}).$$

Here  $c(b_{t-1})$  represents the earnings that must be given up in period  $t$  as a result of borrowing at  $t - 1$ . The function  $c(\ )$  is assumed to be convex, with  $c'(0) = (1 + r)$ , where  $r$  is the discount rate on the firm's stock. Thus, there is an increasing marginal cost to borrowing against future earnings, and the firm's true long-run value is maximized when these borrowings are zero.

This formulation is used to capture the idea that the firm can raise its current income by liquidating certain assets that are not yet "ripe" for liquidation—have a yield of greater than  $r$  relative to the liquidation price—or equivalently, by deciding not to invest in assets that have returns greater than  $r$ . The more current income is to be raised, the more projects have to be sacrificed. The first to go are those that are yielding (or would yield) just  $r$ . Then come those with higher yields—hence the increasing marginal costs.

A crucial assumption is that the amount of borrowing  $b_t$  is not directly observable by outsiders. Clearly, this assumption is not applicable to all types of potential investment by a firm: expenditures on tangible fixed assets, such as a new factory, are easily identified. Nonetheless, many investments are relatively "invisible" in nature, and money spent on them cannot be accurately disentangled from increased operating costs.<sup>3</sup> One example of this might be a commitment by a company to temporarily increasing the

2. The fact that the accounting profession has developed the concept of "extraordinary" earnings suggests that the capital market does indeed face the sort of inference problem described here when extrapolating from current earnings. Presumably, separating out clearly nonrecurring items allows investors to make more accurate forecasts of future firm performance from accounting data.

3. Again, there are accounting conventions designed to make this disentanglement easier. For example, R&D costs are broken out from other expenses that may represent less of an economic investment. However, given the impossibility of drawing absolute lines, any measure of current profitability (whether or not it includes such items as extraordinary earnings, or R&D expenses) will inevitably be negatively affected by some types of long-term investment.

resources devoted to client coverage. Although this is an investment in the sense that it is expected to bring long-term loyalty benefits, the costs may be attributed to increases in operating expenses, and may count against the firm in assessments of its current profitability. Pricing decisions are another area where invisible investment is likely to be important. If switching costs (see Klemperer [1987]) are substantial, firms can "invest" in market share via temporarily reduced prices and profits. In this setting, "myopia" would mean setting prices too high. The effect on prices might run in the opposite direction as well: a durable goods monopolist should respond to a temporary drop in demand by keeping prices up, in spite of the falloff in sales this entails. If he is overly concerned about current performance, however, he may cut prices in a suboptimal fashion, so as to smooth profits over time.<sup>4</sup>

The firm immediately pays out all earnings in the form of a dividend. This dividend is assumed to entail no taxes or other dissipative cost, and hence has no effect on any of the fundamentals of the model. At time  $t$ , after the dividend payout, the market price of the firm's stock is given by

$$(3) \quad P_t = E_t \sum_{j=1}^{\infty} \frac{e_{t+j}}{(1+r)^j},$$

where  $E_t$  denotes the expectation at time  $t$  conditional on the market's information set, which includes all current and past values of the  $e_t$ 's.

Managers are interested in long-run earnings, but they also care about current stock prices. One simple way to model this is to posit them entering each period owning shares of the stock. After that period's dividend payout, they will sell a fraction  $\pi$  of their shares at the market price. The remaining  $(1 - \pi)$  will be held indefinitely.<sup>5</sup> Maximizing the present value of their income will be equivalent to maximizing the following utility at each time  $t$ :

$$(4) \quad U_t = e_t + \pi P_t + (1 - \pi)e_{t+1}/(1+r).$$

4. In both of these pricing examples of myopia, one needs to assume that some information that motivates the pricing decision (i.e., the exact level of demand) is known only by the firm's managers. Otherwise, the "investment" in future sales that is inherent in current pricing policy is no longer invisible to outsiders.

5. This formulation appears to suffer from a slight time consistency problem. At time  $t$  the manager acts as if he will sell some stock at time  $t$  and hold the rest forever. At time  $t + 1$  he contradicts this by acting as if he will sell some stock at time  $t + 1$ . One logical way around this is to assume overlapping generations of managers. However, the formulation is not responsible for the main results here; it is only used to simplify the exposition.

Earnings more than one period into the future can be ignored, as current decisions have no effect on such earnings.

One can imagine a number of reasons why managers might behave as assumed in equation (4). One important possibility (considered in Stein [1988]) is that they would like to hold the stock they own for the longer term, but face a probability  $\pi$  of takeover at time  $t$ , which would force them to tender their shares at the market price. Alternatively, funding requirements might require them to go to the market to issue new stock. These two interpretations of the model will be discussed in more detail later on. There are others as well: the managers may be acting on behalf of shareholders (including themselves) who face liquidity needs and who thus must sell off some stock in each period. Or perhaps managers' compensation in each period is a function of that period's stock price. Since the main purpose here is simply to show how focusing on current stock prices causes managers to behave inefficiently, it is natural to just assume that such prices enter into managerial utility, without being overly specific about why this may be the case.<sup>6</sup>

In a steady state signal-jamming equilibrium, managers will borrow a constant amount each period from the next period's earnings, and the market will correctly anticipate this borrowing. Denote the equilibrium borrowing value by  $\bar{b}$ . The market can reconstruct natural earnings from observed earnings via the following formula:

$$(5) \quad \hat{e}_t^n = e_t + c(\bar{b}) - \bar{b}.$$

Given this past sequence of imputed natural earnings, the expectation of future natural earnings is formed using a distributed lag:

$$(6) \quad \text{for all } k > 0, \quad E_t(e_{t+k}^n) = \sum_{j=0}^{\infty} \alpha_j \hat{e}_{t-j}^n,$$

where the lag coefficient  $\alpha_j$  sum to one and depend on the relative variance  $\sigma_u^2$  and  $\sigma_v^2$ . Of particular interest is the coefficient  $\alpha_0$ , which tells how strong an impact current earnings have on expectations,

6. Related work by Laffont and Tirole [1987] suggests that the parameter  $\pi$  can be endogenized in a very general model. They study the design of optimal contracts for inducing managerial effort, and allow the firm to choose both the manager's stock holding and the probability of takeover (this is presumably controlled via the use of poison pills and other such defensive tactics). They conclude that managers must own stock to encourage effort and that some probability of takeover is allowed even when there are myopia costs, so as to capture potential synergy benefits. This can be thought of as one possible rigorous justification for the formulation used here.

and for which the following expression can be derived (see Holmstrom [1982] for details):

$$(7) \quad \alpha_0 = (k^2/4 + k)^{1/2} - k/2,$$

where

$$(8) \quad k = \sigma_u^2/\sigma_v^2.$$

If  $\sigma_v^2$  is large relative to  $\sigma_u^2$  ( $k$  is close to zero), there is a lot of transitory noise in earnings, so past values are important in forming accurate predictions. Thus,  $\alpha_0$ , the weight on current earnings, is close to zero. Conversely, if  $\sigma_u^2$  is big, permanent earnings tend to evolve rapidly, thereby making older data less helpful. In such a case  $\alpha_0$  is nearer to one.

Consider now the problem faced by a manager at time  $t$ . The market's conjectures about  $\bar{b}$  are a *given*. That is, no matter what level of borrowing  $b_t$  the manager actually chooses, the market will discount earnings to reflect a borrowing of  $\bar{b}$  in every period. (Of course, in equilibrium the manager will choose a  $b_t$  that equals the market's conjecture  $\bar{b}$ . However, in making his decision, the manager takes  $\bar{b}$  as fixed.)

In order to maximize utility, the manager will pick  $b_t$  to satisfy

$$(9) \quad \frac{de_t}{db_t} + \pi \frac{dP_t}{db_t} + \left( \frac{1 - \pi}{1 + r} \right) \frac{de_{t+1}}{db_t} = 0.$$

The derivatives  $de_t/db_t$  and  $de_{t+1}/db_t$  have values 1 and  $-c'(b_t)$ , respectively. This follows immediately from equation (2). The derivative  $dP_t/db_t$  has a value of  $\alpha_0/r$ . Taking the market's conjecture of  $\bar{b}$  as fixed, increasing current observed earnings increases imputed natural earnings one-for-one (see equation (5)) and therefore increases expected future earnings by a factor of  $\alpha_0$  (see equation (6)). Since this increase applies to the entire future earnings stream, the effect on the current stock price is thus  $\alpha_0/r$  times the amount borrowed.

The above derivatives can be substituted into equation (9) to obtain the expression for the equilibrium  $\bar{b}$ :

$$(10) \quad c'(\bar{b}) = [(1 + r)/(1 - \pi)] [1 + \pi\alpha_0/r].$$

If  $\pi = 0$ , so that managers care only about the present value of earnings and not at all about current stock prices, then  $c'(\bar{b})$  equals its first-best value of  $(1 + r)$ . Increasing  $\pi$  above zero leads to increasingly myopic behavior. This myopia also depends on  $\alpha_0$ ; the

more sensitive are future projections to current earnings, the worse the problem will be.

### III. DISCUSSION

#### *A. The Pros and Cons of Capital Market Pressure*

The above analysis implies that excessive "capital market pressure" may have adverse effects on firm performance. In the context of the model, this capital market pressure is measured by the parameter  $\pi$ , which can be given a number of concrete interpretations. One is the likelihood of a takeover attempt. Another is the degree to which the firm has financial "slack;" i.e., cash reserves or flows that permit it to fund its investments without having to issue new stock. The less financial slack there is, the higher is the effective  $\pi$ .

American corporate managers frequently complain about capital market pressure, arguing that it interferes with their ability to pursue long-term objectives. Abeglen and Stalk [1985] discuss survey evidence regarding the corporate objectives of about 500 major U. S. and Japanese companies. U. S. executives ranked share price increases as their second most important objectives out of nine choices, ahead of such alternatives as improved product portfolio, market share, or company image. In contrast, Japanese executives ranked share price increases as the least important of the nine objectives. The authors attribute these differences to the type of factors discussed above as determinants of  $\pi$ : for example, insider-dominated boards and other corporate governance mechanisms that reduce the threat of hostile takeovers in Japan.<sup>7</sup> They go on to claim that:

There is a real competitive advantage in this pattern of shareholder relations for the successful Japanese competitor. [They] are freed from the tyranny of accountants, and from the terrible pressures throughout the U. S. organizations for steady improvements in earnings per share. It is rational for U. S. managers to be preoccupied with short-term earnings . . . the shorter time horizon of the U. S. executive is a function of the system he operates in, and is not necessarily from a lack of understanding or concern over the company's future [p. 188].

7. Another reason why Japanese managers might worry less about stock prices would be if their capital suppliers are better informed. Well-informed capital suppliers (such as banks that are part of a company's industrial group) may function like an extended internal capital market, reducing the need to use the stock price to impress lesser informed outsiders. See Hoshi, Kashyap, and Scharfstein [1988] for an empirical treatment of these issues.

The conclusions reached here are in contrast to those derived from an agency-theoretic view of the firm. Jensen [1986] stresses conflicts of interest between managers and stockholders, and argues that capital market pressure will tend to act as a disciplinary device. Thus, both takeover threats and the decreased levels of financial slack that accompany leveraged buyouts are seen in a positive light. According to this school of thought, managers' complaints about capital market pressure are self-serving and ought not be taken seriously; managers are simply seeking to preserve the discretion they need to run their companies according to their own personal preferences.

In spite of their differing welfare conclusions concerning capital market pressure, both types of models are consistent with several observed regularities. Kaplan [1988] finds that after LBOs, firms tend to reduce both current costs and investment, as compared with non-LBO firms. To an agency theorist, this might represent enhanced operational efficiency and the curtailment of negative NPV projects that were in managers' interest but not shareholders'. However, it is certainly possible that some positive NPV projects are eliminated as well, including some that are accounted for as operating expenses. Again, the example of pricing aggressively to gain market share or learning curve benefits comes to mind. If capital market pressure forces firms to abandon this strategy, the accounting result will be increased current operating margins, and might easily be mistaken as an efficiency increase. As Scherer [1988, p. 78] notes, "(this) could be the most important implication of takeovers, since American industry is confronted by European and especially Asian rivals who . . . practice penetration and learning curve pricing—manifestations of a long-run strategy."

The pure agency view is implicitly optimistic about the precision with which capital market pressure can reduce costs and investment. Only undesirable ones will be eliminated, while worthy ones will be preserved. To the extent that the capital market cannot observe everything that goes into managerial decision making, this optimism is not wholly justified. There are both pros and cons to managerial discretion when managers are better informed than those who would discipline them.

The above model provides a useful framework for evaluating a number of empirical findings that have been introduced into the debate over the myopia hypothesis. The work of McConnell and Muscarella [1985] is an important example in this regard. They find

that stock prices (except in the oil industry) respond positively to announcements of increased investment expenditures. Jensen [1986] argues that this has two implications: (1) that the equity market is not myopic; and (2) hence rational managers do not constrain investment in an attempt to maximize stock prices.

The model of this paper makes it clear why the second inference is an incorrect one. One can think of  $c'(\bar{b})$  as one plus the "hurdle rate" set by managers for new investment projects. Since  $c'(\bar{b})$  exceeds  $(1 + r)$ , this hurdle rate is set too high. Consider now what happens when managers announce that they have found a new project which they deem to be acceptable. Conditional on its being acceptable to myopic managers, the project has a return of *at least*  $c'(\bar{b}) - 1$ . Hence announcement of such a project is surely good news; better news in fact than announcement of a project that is only known to have cleared the first-best hurdle rate of  $r$ . The higher the hurdle rate set by myopic managers, the more favorable should be the market's reaction to discoveries of projects that clear this high hurdle. It is thus totally wrong to conclude from positive announcement effects that managers do not underinvest.

Another fact cited in the myopia debate is the ability of start-up companies—the Genentechs of the world—to command high stock prices while doing a great deal of investment and earning negative current returns. Jensen [1986] offers this as further evidence that stock market pressure does not have an adverse effect on the incentives for long-term development. However, the logic developed above suggests that some care should be taken before generalizing too broadly based on the experiences of start-up companies. As was seen, the extent of the myopia problem will depend on  $\alpha_0$ , which measures the degree to which current earnings are a good predictor of future earnings. For start-up companies whose eventual earnings may largely depend on a product that is not yet even developed, current earnings are likely to provide little information. However, since the same is not necessarily true for more mature firms, they may feel considerably greater short-term earnings pressure, and may respond accordingly.<sup>8</sup>

A final lesson to be drawn from the model is that testing directly for myopia may be quite difficult. The existence of many important types of myopic behavior cannot be empirically refuted using accounting data in a conventional fashion. Indeed, it is

8. A money manager I spoke with says that the joke among analysts of high-tech start-ups is "We don't worry about current earnings—until they turn positive."

precisely those investments that are most easily and accurately summarized on an accounting statement—e.g., expenditures on plant and equipment—which are least likely to be sacrificed in the quest for higher stock prices.

### *B. Firm Structure and the Limits of Integration*

It is often argued that financial considerations influence the extent to which firms expand into related or unrelated lines of business. Expansion can be thought of as creating an internal capital market that generates financial slack.<sup>9</sup> One well-known theoretical justification for financial slack is that of Myers and Majluf [1984]: equity issues suffer from an Akerlof [1970] lemons problem, so that internally generated finance can be cheaper.

The model developed here suggests a second, subtler reason why managers may prefer to build financial slack. Not only are equity issues costly on the day they are carried out (due to the lemons effect), the very knowledge that they are likely to be necessary in the future forces managers to run the company in a suboptimal fashion, pumping up short-term earnings at the expense of the longer run. Building financial slack allows managers to effectively insulate themselves from constant scrutiny by the capital market, and perhaps to operate their firms more efficiently. In this sense, financial slack functions very much like antitakeover devices such as poison pills and defensive charter amendments.

Thus, both models predict some degree of integration for internal capital markets reasons: it may be useful to combine a cash-generating unit with a cash-using unit in order to avoid reliance on external equity. However, the model here is less clear-cut in this regard. It also implies some limits to the desirability of integration for financial purposes.

These limits stem from the fact that signal-jamming will be more of a problem when today's earnings are a precise indicator of the future. As noted above, there is likely to be less incentive to signal-jam in a biotechnology company (where future earnings are completely dependent on the success of R&D efforts) than in a more mature business where current earnings provide important information about evolving demand or cost conditions. If the biotech company is combined with the more mature business, the aggregate signal-jamming problem may worsen—funds from the biotech unit

9. Donaldson [1984] documents that a primary strategic goal for many companies is to generate enough financing internally to be able to do without new equity issues.

may be diverted in an attempt to satisfy the other's appetite for current earnings. Thus, it may be more economically sensible for the two companies to stand separately. This effect, which works through the  $\alpha_0$  term in equation (10), may run counter to the internal capital markets effect, which works through  $\pi$ . To continue with the above example, it may well be that the mature firm is a cash generator and the biotech firm is a cash consumer. Nonetheless, it could still be undesirable to integrate them when all factors are weighed together.

This type of logic can help to explain a number of real-world phenomena. Much attention has been given to the large volume of corporate divestitures and breakups that have accompanied the increased capital market pressure of the past few years. Many observers have rationalized this activity with an argument that seems to contradict efficient markets theory: the stock market can better "appreciate" the individual pieces of a company than their sum. Economists, on the other hand, have tended to claim real operating improvements, such as decreased overhead expenditures, as the driving forces. However, a synthesis of these two views is possible. If a breakup results in a reduction of the aggregate signal-jamming inefficiency, then there will indeed be the real improvement sought by economists. On the other hand, this improvement will be made possible only because the stock market does, in an important sense, "appreciate" certain incremental investments more when they are made in the deconsolidated companies; it is less inclined to lower future earnings projections in response to current decreases.<sup>10</sup>

A related observation can be made concerning the structure of corporate sponsorship of small R&D firms. Analog Devices, Inc., an NYSE-traded semiconductor manufacturer, provides a suggestive case study.<sup>11</sup> In 1980 Analog formed a venture capital subsidiary, Analog Devices Enterprises (ADE), to finance high-technology firms. By the end of 1984 ADE had participated in more than a

10. There is another variant of this theory that also provides a rationale for corporate breakups. If a small biotech company is combined with a large, mature company that does little R&D, investors may tend to focus exclusively on the conglomerate's net earnings figure, implicitly treating R&D in the same way as any other current cost. However, if the biotech firm is split off, both its earnings and its (now proportionately large) R&D budget might be studied separately. Such increased awareness on the part of investors could reduce the incentives to sacrifice R&D for higher earnings.

11. The material in the next two paragraphs is drawn from "Analog Devices Enterprises/Bipolar Integrated Technology," Harvard Business School Case Services, 1986, as well as from Analog annual reports. I thank Bill Sahlman for suggesting this case to me.

dozen such ventures, with a total investment of over \$28 million. Their contracts with the high-tech firms generally included either rights to purchase a controlling stake at some point in the future, or technology transfer and marketing agreements that allowed Analog to use any innovations for their own production and sales purposes. Although the potential economic benefits were thus similar to in-house R&D, financial reporting considerations were quite different. The initial investments in the high-tech firms were carried on Analog's books at cost. The ongoing profits and losses of the high-tech firms did not show up in Analog's income statement so long as the original investment position was left unchanged.<sup>12</sup> Consequently, once the initial investment was made, there was no incentive for the high-tech firms to skimp on needed expenditures in order to boost Analog's earnings.<sup>13</sup> This advantage would not have been present with in-house development, and may have been a factor in motivating the use of such arm's-length arrangements.

In 1985 a change in accounting standards forced Analog to "flow through" the expenses of the companies in the ADE portfolio. This resulted in new "venture expenses" that reduced net profits significantly (venture expenses in 1985-1987 averaged 18 percent of profits). In the 1987 annual report Analog management stated that, "the company expects that the operating results of (the ADE portfolio) will continue to negatively impact earnings in the near term." One might suspect that the separate reporting of venture expenses (they were not lumped in with in-house operating expenses) would tend to partially mitigate any signal-jamming problems, thereby maintaining the appeal of the existing external financing structure. Nonetheless, investments by ADE declined substantially after 1984, after having grown rapidly in the few preceding years—the levels were \$6.1 million and \$4.5 million in 1987 and 1986, respectively, compared with \$9.7 million in 1984. This happened while in-house R&D expenditures continued to grow briskly, not only in absolute terms but as a percentage of sales. It would be interesting to see whether a broader study of corporate

12. This was true so long as the high-tech firm did not perform substantially worse than projected. In the case of large unexpected losses, there might be a write-down of the investment for accounting purposes.

13. This arrangement amounts not only to an informational separation of the high-tech firms from the rest of Analog (as would happen if one public company were broken up into two public companies) but also to a commitment not to reveal information about the progress of the high-tech firms (since these firms are privately held and need not make earnings data publicly available). Such a commitment further reduces the incentives for inefficient signal-jamming behavior.

venture capital subsidiaries finds Analog's experiences to be typical.

### *C. Other Related Theoretical Work*

A few other recent theoretical papers have also argued that short-term stock market considerations may result in myopic resource allocations. Taken together, these papers suggest that myopia can arise from one of three "imperfections": (1) invisibility of some managerial action, (2) *ex ante* superior information on the part of managers, or (3) inefficiencies in stock prices.

The model presented here falls into the first category. So does the work of Laffont and Tirole [1987], which focuses on the design of efficient contracts for encouraging managerial effort. They point out that if investment is invisible, high investment (which leads to high current costs) will be mistaken for low managerial effort. In order to encourage *both* effort and investment, managers have to be residual claimants for several periods, until the fruits of investment can show up in earnings. Laffont and Tirole conclude that it may be optimal to erect some barriers to (otherwise synergistic) takeovers in order to raise the probability that managers will be long-term stockholders, thereby discouraging myopic behavior.

The second category includes Spence [1973] signaling type models. In Stein [1988] I argued that managers of "good" firms would, under takeover pressure, be willing to expend resources in order to establish a "good" rather than "average" stock price. In that paper the signaling was done through current earnings, which resulted in a "pump up the bottom line" flavor similar to that seen here. However, the signaling point is actually much more general, since there are a variety of other devices that can be used to boost stock prices, albeit at a cost. Miller and Rock [1985] argue that dividend signaling leads to underinvestment. The dramatic substitution of debt for equity seen in leveraged buyouts and recapitalizations also contains a signaling element, as better firms are more able to bear the increased burdens of bankruptcy risk and loss of operating flexibility.

The signaling and signal-jamming approaches are best thought of as complementary, implying that myopia can occur in a wide range of circumstances. Even if the firm is not the type to be subject to significant invisible investment, there may be overt myopic behavior—i.e., a debt-financed repurchase that boosts the stock price but compromises future investment—if there is *ex ante* asymmetric information. Conversely, even when information is *ex*

ante symmetric, the existence of invisible investments can lead to myopia.

In one sense, signal-jamming may entail somewhat more pessimistic welfare conclusions than signaling. With signaling, some information is communicated from managers to the marketplace. Thus, in spite of its direct costs, there is the possibility of a positive externality, as one could argue that more informative stock prices lead to better resource allocation. Since no information is communicated in a signal-jamming equilibrium, no positive externality can arise.

Both signaling and signal-jamming models assume rational stock markets participants. The work of DeLong et al. [1987] on noise traders shows that if this assumption is relaxed, short-term stock price considerations can induce myopic behavior even with perfect information. If noise traders introduce mean-reverting disturbances into stock prices, managers with shorter horizons for selling their stock will perceive investments to be more risky and will apply a higher discount rate.

#### IV. CONCLUSIONS

The traditional economists' view is that there is no meaningful distinction between maximizing "short-run" stock prices and "long-run" stock prices: both lead to efficient investment decisions. The message of this paper is that managers' horizons can actually be very important. Shorter horizons (as parameterized by a higher value of  $\pi$ ) lead to increasingly myopic behavior, even when stock market participants are rational.

Myopic corporate behavior can be viewed as the Nash equilibrium outcome of a noncooperative game between managers and the stock market. In an effort to fool the market into predicting higher future earnings, management undertakes a costly inflation of the current bottom line. In equilibrium the market is not fooled, but the myopic behavior persists nonetheless. The Nash approach clearly exposes the fallacy inherent in a statement such as "since managers can't systematically fool the market, they won't bother trying."

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