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# Product-market competition and managerial slack

David Scharfstein\*

*This article analyzes the effect of product-market competition on managerial incentives. In contrast to Hart (1983a), I show that competition may actually exacerbate the incentive problem. The difference in results derives from our different assumptions about managerial preferences. The importance of assumptions about preferences suggests that we do not yet understand the precise mechanism through which competition affects incentives.*

## 1. Introduction

■ Economists often argue informally that product-market competition reduces managerial slack (e.g., Machlup, 1967). Hart (1983a) attempts to formalize this proposition by modelling the effect of competition on the agency problem between a firm's owners and managers. This article reexamines Hart's model and concludes, in contrast to Hart, that market competition can exacerbate incentive problems. I show that the effect of competition on incentives depends critically on the specification of managerial preferences.

The model is roughly as follows. A risk-averse manager can take a costly, unobservable action (effort) that lowers the marginal cost of production and therefore results in greater output and profit (gross of managerial compensation). The marginal and total productivities of effort are perfectly correlated across managers, and they can be either high or low. A manager observes his productivity after signing on with a firm but before making any production decisions. There are two types of firms: entrepreneurial and managerial. The owners of entrepreneurial firms can observe productivity; those of managerial firms cannot.

Usually in agency models there is a tradeoff between insurance and incentives. The more insurance the agent receives, the less sensitive his compensation is to his actions and the greater is his incentive to shirk. An optimal compensation scheme motivates the manager, but does not expose him to excessive risk.

In Hart's (1983a) model, however, the compensation scheme plays no role. This follows from his assumptions about managerial preferences. He assumes that the manager is infinitely risk averse with respect to lotteries over  $V(I) - a$ , where  $I$  is income and  $a$  is effort. The assumption that drives Hart's results is that  $V(I) = \bar{V}$  if income is above some level,  $\bar{I}$ , and  $V(I) = -\infty$  if income is below  $\bar{I}$ . Compensation exceeding  $\bar{I}$  has no value, and compensation below  $\bar{I}$  is infeasible. Without the ability to reward or to penalize, the owner of a managerial firm can motivate the manager only by requiring him to satisfy a single profit target. Hence,

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the manager satisfies: he works only hard enough to meet a fixed profit target. This target is set so that the manager works efficiently when productivity is low, but slacks when productivity is high. Note that this inefficiency does not arise in entrepreneurial firms because in them profit targets can be made contingent on the manager's productivity.

In this framework entrepreneurial firms mitigate the inefficiency in managerial firms. An increase in the fraction of entrepreneurial firms has no effect on equilibrium when productivity is low, but increases output and decreases price when productivity is high. This follows from the fact that entrepreneurial firms are more efficient only when productivity is high. Since price falls when productivity is high, managers must work harder to satisfy the fixed profit target. Thus, entrepreneurial firms discipline managerial firms indirectly via the price mechanism.

The difficulty with this argument is that it depends critically on the supposition that a single profit target is an optimal incentive scheme. If the marginal utility of income is positive and finite, compensation need not be fixed, and a single profit target may not be optimal. To make this point I analyze a model, similar to that of Sappington (1983), in which  $V(I) = I$ .

An incentive scheme specifies two profit targets,  $\pi_H$  and  $\pi_L$ , that the manager must achieve if productivity is high and low, respectively, and two corresponding payments,  $I_H$  and  $I_L$ . In entrepreneurial firms contracts contingent on productivity insure the manager against all variation in productivity and induce efficient effort and production. In managerial firms, however, such contingent contracts are not feasible. An incentive scheme, therefore, must also induce the manager to reveal his private information. When productivity is high, the manager may have an incentive to claim that it is low. The reward for high profit,  $I_H - I_L$ , must be large enough to offset the greater effort required to generate profit  $\pi_H$  rather than  $\pi_L$ . This results in an inefficiency when productivity is *low*: effort, output, and profit are then below the efficient levels. In general, the greater incentive the manager has to underreport his productivity, the greater the resulting inefficiency. It is important to note that here the inefficiency occurs when productivity is *low*, while in Hart's (1983a) model it occurs when productivity is *high*.<sup>1</sup>

To see that entrepreneurial firms can impose a negative externality on managerial firms, consider an increase in the fraction of entrepreneurial firms. This has no effect on equilibrium when productivity is high, but increases output and decreases price when productivity is low. This follows because entrepreneurial firms are more efficient only when productivity is low. As price falls, the profit target  $\pi_L$  falls. It is then easier for a manager with high productivity to satisfy the lower profit target, and hence more expensive to induce him to reveal that productivity is high. This results in a greater inefficiency when productivity is low, and further reduces the profit target. In this setting the presence of entrepreneurial firms actually exacerbates the incentive problem.

Whether competition is beneficial or harmful, therefore, depends on managerial preferences. It also depends on the number of states. With more than two states an increase in the number of entrepreneurial firms generates price changes in all but the most productive state, so that the above argument does not readily generalize. The ambiguity of the results suggests that if competition mitigates incentive problems, this framework does not provide a complete characterization of why it does.

The remainder of the article is organized as follows. The next section outlines the model and characterizes the optimal contract. Section 3 describes market equilibrium in two cases: when productivity is independently distributed across managers and when it is perfectly correlated. Although in Hart's (1983a) model correlation is beneficial, here it has an am-

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<sup>1</sup> Efficiency in the most productive state and inefficiency in all others is a common feature of many related models. See, for example, Hart (1983b) for a similar result in the context of the labor market and Baron and Myerson (1982) in the context of regulation.

biguous effect on incentives. Section 4 formalizes the claim that efficient firms exacerbate the incentive problem and argues that in a free-entry equilibrium there may be an excessive number of efficient firms. Section 5 presents Hart's result in a simpler model and compares the result with the one presented in Section 4. Finally, Section 6 contains concluding remarks.

## 2. The model

■ There is a continuum of competitive firms that produce a homogeneous good, the demand for which is given by  $q = D(p)$ , where  $p$  is market price and  $q$  is quantity demanded per firm. Each firm is run by a manager whose effort,  $a \in [0, \infty)$ , results in output,  $x$ , according to the function  $x = \theta f(a)$ .<sup>2</sup> The parameter  $\theta \in \{\theta_1, \theta_2\}$ , where  $\theta_1 < \theta_2$ , and  $\theta = \theta_i$  with probability  $\alpha_i$ . The function  $f(\cdot)$  is strictly increasing and strictly concave.

At an initial date 0 the owner of each firm offers an employment contract to a manager, which the manager can accept or reject. At that time, neither party knows the realization of  $\theta$ , but its distribution is common knowledge. At a later date 1,  $\theta$  is realized and production occurs.

Revenue is publicly observable, but only the manager observes output and effort. The manager also observes  $\theta$  when it is realized. The owners of a fraction  $\mu$  of the firms may choose to observe  $\theta$  at a cost and condition the contract on  $\theta$ . The owners of the remaining fraction of firms do not observe  $\theta$ . The former are labelled entrepreneurial firms, the latter, managerial firms. The important difference between them is that in entrepreneurial firms the contract can be conditioned on revenue and  $\theta$ , whereas in managerial firms the contract can be conditioned only on revenue. For the moment,  $\mu$  is exogenous; however, Section 4 contains a discussion of the implications of endogenizing  $\mu$ .

Hart (1983a) considers the utility function,  $U(V(I) - a)$ , where  $I$  is income, and makes the following two assumptions.

*Assumption 1.*  $V(I) = -\infty$  if  $I < \bar{I}$  and  $V(I) = \bar{V} > 0$  if  $I \geq \bar{I}$ .

*Assumption 2.*  $-U''(\cdot)/U'(\cdot) = \infty$ .

Assumption 1 states that the utility of income is constant above some income level,  $\bar{I}$ , and  $-\infty$  below it. Assumption 2 states that the manager is infinitely risk averse. The analysis turns on Assumption 1, not on Assumption 2. Instead of Assumption 1, I consider the case of Assumption 1a and show that Hart's results are reversed.

*Assumption 1a.*  $V(I) = I$ .

Although Assumption 2 appears strong, the results only require that the manager be risk averse.

For simplicity, at date 0, the manager's reservation income is zero. Assumption 2 implies that the manager's expected utility at date 0 is his minimum utility at date 1. Thus, the manager will accept a contract at date 0 only if his net income at date 1 is at least zero in both states.

□ **The optimal contract in entrepreneurial firms.** A contract for an entrepreneurial firm specifies a payment to the manager  $I_i$  in state  $i$  if revenue is  $R_i$ . Following Hart (1983a), I exclude contracts based on the market price and the revenues of other firms. I discuss the importance of this assumption in the following section.

It is useful to define a function that specifies the effort required to produce revenue  $R$

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<sup>2</sup> This formulation, narrowly interpreted, is unrealistic but captures the main idea in Hart's (1983a) more realistic model. In that model managers exert effort to lower production costs. This results in greater output and profit. The analysis is complicated because the manager chooses both effort and output. The analysis here is simpler because it suppresses the output choice and posits a direct relationship between effort and output and profit.

in state  $i$ . Let  $h(\cdot)$  be the inverse of  $f(\cdot)$ ;  $h(\cdot)$  is strictly increasing and convex. Therefore, the effort required to generate revenue  $R$  in state  $i$ , given price  $p$ , is  $h(R/p\theta_i)$ .

The optimal contract for an entrepreneurial firm,  $(R_1^*, I_1^*, R_2^*, I_2^*)$ , maximizes expected profit (expected revenue less expected compensation) subject to an individual-rationality constraint that ensures that the manager wishes to sign the contract:

$$\max_{\{R_i, I_i\}} \sum_{i=1}^2 \alpha_i (R_i - I_i),$$

subject to

$$I_i - h(R_i/p_i\theta_i) \geq 0, \quad i = 1, 2, \quad (1)$$

where  $p_i$  is price in state  $i$ .

At an optimum  $R_i^*$  solves

$$h'(R_i^*/p_i\theta_i)/\theta_i = p_i; \quad (2)$$

in state  $i$  marginal revenue,  $p_i$ , is equal to the marginal cost (disutility) of output. Alternatively, the optimal effort level in state  $i$ ,  $a_i^*$ , solve  $p_i\theta_i f'(a_i^*) = 1$ ; the marginal revenue product of effort is equal to the marginal disutility of effort. It follows that if  $p_i\theta_i > p_j\theta_j$ , then  $R_i^* > R_j^*$  and  $a_i^* > a_j^*$ ,  $i \neq j$ . Finally, note that constraint (1) is binding in each state so that  $I_i^* = h(R_i^*/p_i\theta_i)$ , and there is complete insurance.

□ **The optimal contract in managerial firms.** The owner of a managerial firm can condition compensation only on revenue, since  $\theta$  is not publicly observable. By the revelation principle (Dasgupta, Hammond, and Maskin, 1979), we need only consider contracts that induce the manager to report  $\theta$  truthfully, i.e., contracts that are incentive-compatible.

A contract specifies that if the manager reports  $\theta_i$ , the owner pays the manager  $I_i$ , provided revenue is  $R_i$ . An incentive-compatible contract satisfies the following constraints:

$$I_1 - h(R_1/p_1\theta_1) \geq I_2 - h(R_2/p_1\theta_1) \quad (3)$$

$$I_2 - h(R_2/p_2\theta_2) \geq I_1 - h(R_1/p_2\theta_2). \quad (4)$$

Incentive-compatibility constraints (3) and (4) guarantee that the manager reports  $\theta$  truthfully. They incorporate the assumption that the manager takes price as given when choosing effort. Thus, if the manager reports state  $j$  when it is state  $i$ , he must satisfy the revenue target,  $R_j$ , given price in state  $i$ ,  $p_i$ .

Note that the optimal contract for an entrepreneurial firm is not incentive compatible for the managerial firm. For state  $i$  such that  $p_i\theta_i > p_j\theta_j$ ,

$$I_j^* - h(R_j^*/p_i\theta_i) > I_j^* - h(R_j^*/p_j\theta_j) = I_i^* - h(R_i^*/p_i\theta_i) = 0;$$

the manager prefers to work less hard (shirk) in state  $i$  and generates revenue  $R_j^*$  rather than  $R_i^*$ . This follows because the contract provides excessive insurance; rewards and penalties are not high enough to prevent the manager from shirking when productivity is high.

An optimal incentive-compatible contract maximizes expected profit subject to (1) and the incentive-compatibility constraints, (3) and (4). It turns out that if  $p_2\theta_2 > p_1\theta_1$ , only (4) is binding at an optimum; and if  $p_1\theta_1 > p_2\theta_2$ , only (3) is binding at an optimum. Thus, the manager must be prevented from claiming that the state is the one with the lower marginal product of effort. Let  $\hat{I}_i$  and  $\hat{R}_i$  be the solution to this program, and let  $\hat{a}_i$  and  $\hat{x}_i$  be the effort and output levels corresponding to this solution. The following proposition characterizes the optimal solution.

*Proposition 1.* Let  $p_i\theta_i > p_j\theta_j$ ,  $i \neq j$ . The optimal contract in managerial firms involves (i)  $h'(\hat{R}_i/p_i\theta_i)/\theta_i = p_i$  and (ii)  $h'(\hat{R}_j/p_j\theta_j)/\theta_j < p_j$ ; given prices, the levels of revenue, output, and effort are equal to their efficient levels in state  $i$  and below their efficient levels in state  $j$ .

This proposition, the proof of which is omitted, is a variation on a well-known result in the literature on optimal contracting under asymmetric information. Sappington (1983), for example, establishes an equivalent result in a model with a more general production function.<sup>3</sup>

The result can be understood as follows. Suppose, for example, that  $p_2\theta_2 > p_1\theta_1$ . (An analogous argument can be made if  $p_1\theta_1 > p_2\theta_2$ .) Then the manager needs to exert less effort in state 2 than in state 1 to satisfy any fixed revenue target. As discussed earlier, the first-best (state-contingent) contract is not incentive-compatible; if the manager shirks in state 2, his utility is  $h(R_1/p_1\theta_1) - h(R_1/p_2\theta_2) > 0$ , but if he does not shirk, his utility is zero. To prevent the manager from shirking,  $I_2$  must be increased. But, since the benefit from shirking,  $h(R_1/p_1\theta_1) - h(R_1/p_2\theta_2)$ , is increasing in  $R_1$  (by the convexity of  $h(\cdot)$ ), a reduction in  $R_1$  decreases the amount by which  $I_2$  must be increased to maintain incentive compatibility. A small reduction in  $R_1$  away from the efficient level,  $R_1^*$ , has a zero first-order effect on profits in state 1, but a positive first-order effect on profits in state 2, through its effect on  $I_2$ . Thus,  $\hat{R}_1 < R_1^*$ .

### 3. Market equilibrium

■ If  $\theta$  is distributed independently across firms, the market price is independent of any particular firm's realization of  $\theta$ . Thus, whether a firm draws  $\theta_1$  or  $\theta_2$ , the market price it faces will be the same;  $p_1 = p_2 \equiv p$ . Since  $\theta_2 > \theta_1$ , it follows that  $p_2\theta_2 > p_1\theta_1$ . Proposition 1 then implies that in managerial firms effort and output are efficient in state 2, but inefficient in state 1.

If  $\theta$  is perfectly correlated across firms,  $p_1$  is not generally equal to  $p_2$ . The following proposition, the proof of which is in the Appendix, partly characterizes equilibrium when shocks are perfectly correlated.<sup>4</sup>

*Proposition 2.* Suppose that  $\theta$  is perfectly correlated across firms. If demand is elastic, then  $p_2\theta_2 > p_1\theta_1$ ; effort, output, and revenue are set at the efficient levels in state 2 and below the efficient levels in state 1. If demand is inelastic, the reverse is true. In both cases  $p_1 > p_2$ .

If demand is elastic, although output is higher and price is lower in state 2, the marginal revenue product of effort is still greater in state 2. In contrast, if demand is inelastic, higher output results in relatively lower prices, so that the marginal revenue product of effort is lower in state 2. For simplicity, I focus on the case of elastic demand, although the substantive results concerning the effect of competition on incentives do not depend on the elasticity of demand.

The assumption that the contract cannot be conditioned on market price, however, is crucial. Since  $p_1 > p_2$ , the market price perfectly reveals the state. Thus, a contract contingent on price is equivalent to a contract contingent on the state, and it achieves the first-best. Following Hart (1983a), I ignore price-contingent contracts to focus on how the market works as an implicit incentive scheme. This is in contrast to several articles (e.g., Holmström, 1982; Nalebuff and Stiglitz, 1983) that argue that competition is beneficial because it enables firms to base compensation on relative performance.

Hart (1983a) argues that correlation in  $\theta$  improves incentives and efficiency. In his model, as the degree of correlation changes, prices, output, and welfare change, even in the first-best. In general, whether welfare increases or decreases as the degree of correlation

<sup>3</sup> Sappington assumes that the agent is risk neutral but can terminate the relationship at date 1 if his opportunities elsewhere are more attractive. This limited liability assumption, however, is formally identical to Assumption 2. Sappington's results therefore apply in this model. This model is also isomorphic to one in which the manager has private information about  $\theta$  at date 0.

<sup>4</sup> I thank Eric Maskin for suggesting this proposition.

changes depends on properties of the demand and supply curves. Thus, simply comparing output, prices, and welfare under the two regimes cannot tell us anything about the effect of correlation on incentives.<sup>5</sup>

The stochastic structure of the model, however, can have a direct impact on the incentive problem. Suppose, for example, that demand is elastic. Then  $p_2\theta_2 > p_1\theta_1$ , and the manager's utility from shirking is  $h(R_1/p_1\theta_1) - h(R_1/p_2\theta_2) = h(x_1/\theta_1) - h(p_1x_1/p_2\theta_2)$ . If productivity is independently distributed,  $p_1 = p_2$ , so that the utility from shirking does not directly depend on market prices. If, instead, productivity is perfectly correlated, then  $p_1 > p_2$ , and the utility from shirking depends directly on market prices. In this case with  $x_1$  held fixed, correlation lowers the utility from shirking and would appear to be beneficial.

If demand is inelastic, however, the effect is reversed. In this case  $p_1\theta_1 > p_2\theta_2$ , and the utility from shirking is  $h(R_2/p_2\theta_2) - h(R_2/p_1\theta_1) = h(x_2/\theta_2) - h(p_2x_2/p_1\theta_1)$ . Again, if productivity is independent, prices have no direct impact on the utility from shirking. If productivity is correlated, however, then  $p_1 > p_2$ , and the utility from shirking is larger for any given  $x_2$ . Thus, in general, correlation has ambiguous effects on incentives.

#### 4. The externality from entrepreneurial firms

■ In this section I analyze the effect of competition on incentives. An increase in competition is modelled as an increase in the fraction of entrepreneurial firms. This allows us to evaluate the claim (proposed by Machlup (1967) and others) that efficient firms discipline inefficient ones. This exercise, however, does not allow us to address a natural question: Is managerial slack increased under imperfect competition?

The following proposition, which I prove in the Appendix, characterizes the effect of entrepreneurial firms on product-market equilibrium.

*Proposition 3.* Suppose that shocks are perfectly correlated and demand is elastic. An increase in  $\mu$ , the fraction of entrepreneurial firms, lowers price in state 1 and lowers the output and effort of managerial firms in state 1; it has no effect on price, output, and effort in state 2.

The proof of Proposition 3 establishes that managerial and entrepreneurial firms both have upward sloping supply functions. Since the aggregate supply function is a weighted average of these two supply functions, an increase in the fraction of more efficient, entrepreneurial firms shifts out the aggregate supply function. Therefore, price falls along with the output of managerial firms.

The reduction in price reduces managerial firms' output for two reasons: it lowers marginal revenue (the standard reason) and *it increases marginal cost*. The latter effect arises because a reduction in  $p_1$  exacerbates the incentive problem. Thus, the existence of entrepreneurial firms imposes a negative externality on managerial firms.

These effects can be seen from equation (5), which I derive in the Appendix. This equation is the first-order condition for output in state 1,  $\hat{x}_1$ :

$$\alpha_1[p_1 - h'(\hat{x}_1/\theta_1)/\theta_1] - \alpha_2[h'(\hat{x}_1/\theta_1)/\theta_1 - h'(p_1\hat{x}_1/p_2\theta_2)p_1/p_2\theta_2] = 0. \quad (5)$$

The first bracketed expression in (5) is the marginal effect on profits of an increase in  $x_1$  in the absence of an incentive problem. In entrepreneurial firms this expression equals zero at an optimum. The second expression reflects the incentive costs of an increase in  $x_1$ . Recall that if the manager shirks, his utility is  $I_1 - h(p_1x_1/p_2\theta_2) = h(x_1/\theta_1) - h(p_1x_1/p_2\theta_2)$ . Since  $p_2\theta_2 > p_1\theta_1$ , an increase in  $x_1$  increases the manager's compensation by more than the increase in effort needed to produce output  $x_1$ . Increasing  $x_1$  is costly because  $I_2$  must be increased to maintain incentive compatibility.

<sup>5</sup> See Turnovsky (1976) for a treatment of this issue in a standard model of perfect competition.

It is clear from (5) that a decrease in  $p_1$  raises the incentive costs of an increase in output. For lower  $p_1$  effort  $h(p_1x_1/p_2\theta_2)$  increases by less when  $x_1$  is increased. Thus, increasing  $x_1$  makes shirking even more attractive when  $p_1$  is lower. The increase in marginal cost combined with the reduction in marginal revenue leads to lower output.

By exacerbating the incentive problem, entrepreneurial firms impose a negative externality on managerial firms. The basic idea is that an increase in entrepreneurial firms lowers  $p_1$  and increases the difference in the marginal product of effort in the two states. When productivity is high, it is more beneficial for a manager to pretend that productivity is low. The costs of inducing truth-telling rise, and output falls.

Note that this result does not immediately extend to more than two states. If there are  $n > 2$  states, the optimal contract involves efficiency in the  $n$ th (the most productive) state and inefficiency in all other states. As  $\mu$  increases,  $p_i$  decreases in all states but the  $n$ th. Thus, the inefficiency in state  $i$  increases (decreases) if  $p_{i-1}/p_i$  decreases (increases). Since  $p_n$  is constant,  $p_{n-1}/p_n$  decreases, and slack in state  $n - 1$  increases. For states  $i = 1, \dots, n - 1$ , however, the effect of  $\mu$  on  $p_{i-1}/p_i$  depends on the demand curve and the technology and is therefore ambiguous without further specification of those functions.

Given the negative externality of entrepreneurial firms (when there are two states), the market may generate excessive competition. Suppose that an owner can choose whether to establish an entrepreneurial firm or a managerial firm and that it is more costly to establish an entrepreneurial firm. This would be true, for example, if there were fixed costs in monitoring the manager. Although fixed costs are greater for an entrepreneurial firm, marginal costs are higher for a managerial firm. Provided the difference in fixed costs is not excessive, both types of firm will exist in a free-entry equilibrium. In deciding whether to enter, however, potential owners of entrepreneurial firms do not take into account the negative externality they impose on managerial firms. Thus, one can show that in a free-entry equilibrium there will be too many entrepreneurial firms relative to a social optimum.<sup>6</sup> This is in contrast to Hart's (1983a) result.

## 5. Hart's result revisited

■ This section replicates Hart's (1983a) result in a much simpler model and demonstrates the importance of Assumption 1. Under Assumption 1 in both entrepreneurial and managerial firms the manager's compensation is  $\bar{I}$  in both states. A payment below  $\bar{I}$  violates the individual-rationality constraint; a payment above  $\bar{I}$  has no value, since above  $\bar{I}$  the manager's marginal utility of income is zero.

Given  $I_1 = I_2 = \bar{I}$ , it follows from (1) that the maximum feasible effort level in both states is  $\bar{V}$ . In entrepreneurial firms, therefore,  $R_i^* = p_i\theta_i f(\bar{V}) \equiv \bar{R}_i$ , and the manager sets  $a_1^* = a_2^* = \bar{V}$ . This contract, however, is not incentive-compatible in managerial firms: the manager would always choose to meet the lower revenue target. The only incentive-compatible contract is one in which  $\hat{R}_1 = \hat{R}_2$ , i.e., a single revenue target. If demand is elastic ( $p_2\theta_2 > p_1\theta_1$ ), the largest target consistent with (1) is  $\hat{R}_1$ . Thus, in state 1 the manager chooses the efficient effort level,  $\bar{V}$ ; in state 2, the manager works only hard enough to satisfy the target  $\hat{R}_1$ :  $\hat{a}_2$  solves

$$p_2\theta_2 f(\hat{a}_2) = p_1\theta_1 f(\bar{V}). \quad (6)$$

Under Assumption 1 the manager slacks in state 2 and not, as when  $V(I) = I$ , in state 1.

Note that supply in state 1 equals  $\theta_1 f(\bar{V})$  for all  $p_1$ ; supply is perfectly inelastic. From (6), the supply curve in state 2 is *downward* sloping; when  $p_2$  increases, the manager must exert less effort and produce less output to satisfy the revenue target,  $\hat{R}_1$ .

In this model an increase in the fraction of entrepreneurial firms has no effect on  $p_1$ , but lowers  $p_2$  since entrepreneurial firms are more efficient only in state 2. When  $p_2$  decreases,

<sup>6</sup> A proof is contained in Scharfstein (1986).



the manager must work harder to satisfy the fixed target,  $\bar{R}_1$ . Here, entrepreneurial firms provide a *positive* externality for managerial firms. Indeed, one can show that in a free-entry equilibrium, too few entrepreneurial firms will be established relative to a social optimum.<sup>7</sup>

Under Hart's (1983a) specification of managerial preferences, the existence of entrepreneurial firms reduces the difference in the marginal product of effort in the two states. This makes it less attractive for a manager to misrepresent the true state. The key to the different results is that under Hart's specification, the manager shirks when productivity is high, while under alternative assumption on preferences (Assumption 1a), the manager shirks when productivity is low.

## 6. Conclusion

■ In the model analyzed here the effect of competition on incentives depends, among other things, on the specification of managerial preferences. These results could be narrowly interpreted as a partial characterization of the conditions under which competition is beneficial or harmful. The ambiguous nature of the results suggests, however, that we do not yet understand the precise mechanism through which competition affects incentives. A potential difficulty with our approach is the specification of the managerial incentive problem. We have little evidence on the nature of the conflict between shareholders and managers and still less evidence on how these conflicts are resolved. Until we understand more about agency problems, it will be difficult to say much with confidence about the interaction between market competition and incentives.

## Appendix

■ The proofs of Propositions 2 and 3 follow.

*Proof of Proposition 2.* (i) In the case of elastic demand, suppose instead that  $p_1\theta_1 > p_2\theta_2$ . Since  $p_1\theta_1 > p_2\theta_2$ ,  $\theta_2 > \theta_1$  implies that  $p_1 > p_2$  and hence that total output is less in state 1 than in state 2:

$$\mu\theta_1 f(a_1^*) + (1 - \mu)\theta_1 f(\hat{a}_1) < \mu\theta_2 f(a_2^*) + (1 - \mu)\theta_2 f(\hat{a}_2).$$

Since demand is elastic,

$$p_1\theta_1[\mu f(a_1^*) + (1 - \mu)f(\hat{a}_1)] < p_2\theta_2[\mu f(a_2^*) + (1 - \mu)f(\hat{a}_2)]. \quad (A1)$$

But from Proposition 1, with  $p_1\theta_1 > p_2\theta_2$ ,  $\hat{a}_1 = a_1^* > a_2^* > \hat{a}_2$ , so that

$$\mu f(a_1^*) + (1 - \mu)f(\hat{a}_1) > \mu f(a_2^*) + (1 - \mu)f(\hat{a}_2). \quad (A2)$$

Taking together the assumption that  $p_1\theta_1 > p_2\theta_2$  and its implication (A2), we have that the left-hand side of (A1) is greater than the right-hand side, which is a contradiction. Thus,  $p_2\theta_2 > p_1\theta_1$ , output is greater in state 2, and  $p_1 > p_2$ .

(ii) In the case of the inelastic demand, suppose instead that  $p_2\theta_2 > p_1\theta_1$ . Then  $\hat{a}_2 = a_2^* > a_1^* > \hat{a}_1$ . Thus,

$$\mu f(a_2^*) + (1 - \mu)f(\hat{a}_2) > \mu f(a_1^*) + (1 - \mu)f(\hat{a}_1). \quad (A3)$$

Since demand is inelastic,

$$p_2\theta_2[\mu f(a_2^*) + (1 - \mu)f(\hat{a}_2)] < p_1\theta_1[\mu f(a_1^*) + (1 - \mu)f(\hat{a}_1)].$$

But from (A3) this implies that  $p_2\theta_2 < p_1\theta_1$ , which is a contradiction. Since  $\theta_2 > \theta_1$ ,  $p_1 > p_2$ . *Q.E.D.*

*Proof of Proposition 3.* Aggregate supply in state  $i$  is:

$$\mu x_i^*(p_i) + (1 - \mu)\hat{x}_i(p_i),$$

where  $x_i^*(p_i)$  and  $\hat{x}_i(p_i)$  denote the output of entrepreneurial firms and managerial firms, respectively.

An increase in  $\mu$  clearly has no effect on equilibrium in state 2 because  $\hat{x}_2(p_2) = x_2^*(p_2)$  for all  $p_2$ ; since  $\hat{x}_1(p_1) < x_1^*(p_1)$  for all  $p_1$ , however, an increase in  $\mu$  affects equilibrium in state 1. The following argument establishes that  $p_1$  and  $\hat{x}_1$  decrease.

<sup>7</sup> As shown in Scharfstein (1986), these results generalize to the case where  $V(I) = \beta I$  for  $I \geq \bar{I}$ , where  $\beta$  is small. If  $\beta$  is large, the results of the previous section apply: competition increases managerial slack.

First, suppose that  $\hat{x}_1$  and  $x_1^*$  are increasing in  $p_1$ . (This is verified below.) Further, suppose that contrary to the proposition, an increase in  $\mu$  increases  $p_1$ . Then, since  $x_1^*$  and  $\hat{x}_1$  increase and  $x_1^*(p_1) > \hat{x}_1(p_1)$ , aggregate supply increases. This is inconsistent with the reduction in demand associated with an increase in  $p_1$ . Thus, if supply curves are upward sloping,  $p_1$  must decrease.

The following argument establishes that  $\hat{x}_1(p_1)$  is indeed increasing in  $p_1$ . Since (3) and (4) are the only binding constraints,  $\hat{x}_1$  maximizes

$$\alpha_1[p_1x_1 - h(x_1/\theta_1)] - \alpha_2[h(x_1/\theta_1) - h(p_1x_1/p_2\theta_2)],$$

where we substitute  $p_1x_1$  for  $R_1$ . Note that since there is a one-to-one correspondence between  $R_1$  and  $x_1$ , it is possible to maximize with respect to  $x_1$ .

At an optimum we have equation (5):

$$\alpha_1[p_1 - h'(\hat{x}_1/\theta_1)/\theta_1] - \alpha_2[h'(\hat{x}_1/\theta_1)/\theta_1 - h'(p_1\hat{x}_1/p_2\theta_2)p_1/p_2\theta_2] = 0.$$

The term,  $\alpha_1 p_1$ , is the expected marginal revenue of output; the remaining terms sum to the marginal (utility) cost of output. An increase in  $p_1$  increases marginal revenue and *lowers* marginal cost. Thus, assuming that the second-order conditions are satisfied,  $\hat{x}_1$  is increasing in  $p_1$ . Straightforward comparative statics with respect to equation (1) establish that  $x_1^*$  is increasing in  $p_1$ .

It follows that since managerial firms and entrepreneurial firms have upward sloping supply curves, an increase in  $\mu$  lowers  $p_1$  and the output and effort of managerial firms in state 1. *Q.E.D.*

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