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**The Effects of Competitive Pressures  
on Executive Behavior**

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Abstract

Economists presume that competitive pressures, whether in the product market or in the corporate control market, spur a firm's executives to work better. This paper offers support for this presumption. It does so by modifying the standard principal-agent model in a seemingly trivial way -- it gives the bargaining power to the executive. The consequences of this, however, are striking. Firstly, it can reverse the comparative statics. Secondly, it allows one to show that competition is beneficial without having to assume that competition changes the information structure of the problem. Finally, its predictions are more consistent with empirical findings.

JEL Classification: 026, 022



# THE EFFECTS OF COMPETITIVE PRESSURES ON EXECUTIVE BEHAVIOR<sup>1</sup>

## 1. Introduction

A common belief among economists is that competition, whether in the product market or in the corporate control market, causes firms to perform better. In particular, competition is believed to spur a firm's managers to work harder or better -- as Hicks (1935, p. 8) wrote, "the best of all monopoly profits is a quiet life." This paper offers some theoretical support for these beliefs.

Recent work by Hart (1983), Scharfstein (1988a), and McAfee and McMillan (1989) on product market competition, and Scharfstein (1988b) on competition for control, has also sought to provide such support. My paper differs from these papers in a seemingly minor way: whereas they assume the shareholders have all the bargaining power when contracting with the executive, I assume that it is the executive who has all the bargaining power.<sup>2</sup> This minor change, however, has striking implications.

Firstly, switching the bargaining power can reverse the comparative static analysis. When the executive has the bargaining power, he determines both his expected income and his consumption of "agency goods" (e.g., slacking, perquisites, empire building, and other forms of at-the-expense-of-the-shareholders behavior). One can view the executive as "purchasing" these goods from the shareholders at the price of a lower expected income. Furthermore, for a given amount of agency goods, the executive's expected income varies one-for-one with the firm's expected profits (gross of the executive's salary). An increase in competition decreases expected

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<sup>2</sup> The second half of McAfee and McMillan (1989) also has "bottom-up" contracting. Their model, however, is quite different from the one presented here. In particular, they are concerned with the size of the firm's hierarchy in a hidden information model, whereas I am concerned with a two-tier (principal and agent) hierarchy in a hidden action model.

profits, and thus, for a given amount of agency goods, decreases his expected income. If these agency goods are normal goods -- which they typically are assumed to be in principal-agent problems -- then the executive will "purchase" less of them as competitive pressures increase. The way he does this is to offer a new compensation contract that is incentive compatible with consumption of fewer agency goods. Hence, an increase in competitive pressures leads to consumption of less agency goods; that is, it leads to the executive working "harder".

These comparative statics can be reversed in the "classic" principal-agent model, in which the shareholders have the bargaining power. The shareholders benefit from limiting the executive's consumption of agency goods because doing so increases their expected profits. The cost is that they must give the executive a more expensive incentive contract. If competition reduces profits (i.e., the benefits of limiting agency), without affecting the costs of agency, then shareholders will respond by offering cheaper incentive contracts that allow the executive more agency goods; that is, an increase in competition leads to the executive "taking it easy".

Secondly, when the executive has the bargaining power, competition can lead to better firm performance even when competition does not change the model's information structure. In contrast, the benefits of competition arise in the previous papers because competition changes the information structure in a manner favorable to the principal. For example, in Hart (1983), competition allows the principal to make inferences about shocks to factor prices (the agent's private information). In Scharfstein (1988b), the principal can exploit a raider's bid as an *ex post* signal of the agent's private information when designing the optimal compensation scheme. Although it is reasonable that a change in the competitive environment will change the information structure, it is less clear what that change will be. Scharfstein (1988b) notes that the conclusions of his model can be sensitive to how the information structure changes. In addition, as Scharfstein (1988a) shows, even when

the information structure changes for the "better", the welfare consequences may be ambiguous. It is, therefore, worthwhile to show that competition can have the hypothesized effect even when it does not change the information structure.

Finally, this model's predictions seem more consistent with empirical findings than do the classic model's predictions. For instance, Jensen and Murphy (1990) find that compensation is not as sensitive to performance as the classic model would seem to predict. As I will show (Corollary to Proposition 1), this model predicts that executives can be induced to take easier actions than the classic model predicts. Since easier actions are generally associated with less sensitive incentive schemes, this model, therefore, appears more consistent with Jensen and Murphy's findings.

The astronomical increase in average CEO income in the 1980s (128% in real terms)<sup>3</sup> is difficult to reconcile with the classic model, but less difficult to reconcile with this model. An explanation for this phenomenon may lie in the increase in competition that occurred in this period. The eighties are, for instance, widely seen as a decade of deregulation, great takeover activity, and increased foreign competition.<sup>4</sup> In this model, an increase in competition can cause executives to work harder (consume less agency goods), which can make their expected income rise (an example of this is given in Section 3). In contrast, in the classic

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<sup>3</sup> Source: *Business Week*, May 1, 1989. This is the increase from 1980 to 1988. This rate of increase greatly exceeds the 31% real increase in corporate profits or 56% real increase in stock prices over the same period. (Source: *The Economic Report of the President*, 1990. Corporate profits are from Table C-87, and are corporate profits after inventory valuation and capital consumption adjustments. Stock prices are from Table C-93, and represent a New York Stock Exchange composite index. Calculations using other measures of corporate profits and stock prices yield similar results.) As a comparison, note that, from 1960 to 1980, the real rate of increase of average CEO income was 18%.

<sup>4</sup> In 1980 dollars, the total value of merger, acquisition, and leveraged buyouts went from under \$50 billion in 1980 to over \$150 billion in 1988 (Source: *Business Week*, January 15, 1990). Over the same interval, total imports increased by 82% in real terms (Source: *Economic Report of the President*, 1990).

model, an increase in competitive pressures cannot lead to an increase in expected income (Proposition 2).<sup>5</sup>

Assuming the executive has all the bargaining power is clearly extreme, but arguably more realistic than assuming the shareholders have it -- thousands of shareholders are unlikely to bargain effectively against a small number of executives. The institutional facts are also consistent with the assumption that the executive has the bargaining power. The compensation of top executives is set by the board of directors, who are selected largely by management (see Mace (1971) and Herman (1981)). And even though the board's compensation committee usually consists exclusively of outside (non-management) directors, the evidence that outside directors act only in the shareholders' interest is poor at best.<sup>6</sup>

I present and analyze the model in the next two sections. The initial focus is on the market for corporate control. Later, I show simple models of increased product market competition yield similar predictions. In Section 4, I compare these predictions to those of the classic principal-agent model. I conclude in Section 5.

## 2. Model

The two players in this model are the executive (the agent) and the shareholders (the principal). The executive takes an action,  $p$ , that induces a probability density over a space,  $\{x_1, \dots, x_n\}$ , of possible profit levels (gross of the executive's salary). Since the mapping from actions to the densities they induce can

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<sup>5</sup> Assuming no change in the information structure.

<sup>6</sup> Weisbach (1987) finds that outsider-dominated boards are slightly more likely to dismiss the CEO for poor performance than insider-dominated boards. On the other hand, Hermalin and Weisbach (1987) find no evidence that firm performance is better for firms with outsider-dominated boards than for firms with insider-dominated boards. Moreover, as compensation for being a director is a significant fraction of total income for many outside directors (e.g., university presidents, retired public officials, and heads of philanthropic organizations) and as they serve largely at the discretion of top management (see Mace (1971) for evidence), many outside directors may have a strong financial reason to act in management's interest.

be subsumed, I take, without loss of generality, the executive's action to be choosing a density. So  $\mathbf{p}$ , therefore, stands for both the executive's action and the density that action induces. For convenience, I write densities as vectors:  $\mathbf{p} = (p_1, \dots, p_n)'$ ,<sup>7</sup> where  $p_i$  is the probability of the  $i$ th profit level given the executive took action  $\mathbf{p}$ . Define  $\mathbf{x} = (x_1, \dots, x_n)'$ . So  $\mathbf{p}'\mathbf{x}$  is the expected value of  $x$  conditional on action  $\mathbf{p}$ . Assume that  $\mathcal{P}$ , the set of possible actions, is finite and indexed by  $k$ ,  $k = 0, \dots, m$ . Assume every profit level is possible under every action (i.e.,  $\forall \mathbf{p} \in \mathcal{P}$  and  $\forall i, p_i > 0$ ). Label the actions so that expected (gross) profits are increasing with the index:

$$k > j \implies \mathbf{p}^k' \mathbf{x} > \mathbf{p}^j' \mathbf{x}.$$

Assume that the shareholders are so well diversified, that they are risk-neutral. Let  $U(s, \mathbf{p})$  be the executive's utility over salary,  $s$ , and action. As is typical, assume  $U(s, \mathbf{p})$  is additively separable between money and action, i.e.,

$$U(s, \mathbf{p}) = v(s) - c(\mathbf{p}).$$

Assume that  $v(s)$  is continuous, twice-differentiable, strictly increasing, concave, and has an unbounded range. Hence, the inverse function  $v^{-1}(\cdot)$  exists and, for all utility levels  $u \in \mathbb{R}$ , there exists an  $s$  such that  $u = v(s)$ .<sup>8</sup>

Consistent with the notion that the consumption of less agency goods increases expected profits, but decreases the executive's utility, assume that an action's disutility is increasing with its index. That is,

$$k > j \implies c(\mathbf{p}^k) > c(\mathbf{p}^j).$$

As a shorthand for this,  $\mathbf{p}^k$  is a *harder* (*easier*) action than  $\mathbf{p}^j$  if  $k > (<) j$ . The executive may find some actions harder (i.e., provide less utility) than others

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<sup>7</sup> I use the prime (') to denote vector transpose, bold-face lower-case letters to denote vectors, and regular-type lower-case letters to denote their elements.

<sup>8</sup> The unboundedness assumption is made largely for convenience, for most of what follows it could be relaxed.



because they, for example, represent less perquisite taking or less empire building. Alternatively, they may be physically harder or represent less leisure.

Unlike most principal-agent models, I assume the agent has the bargaining power. Specifically, the executive can offer and have accepted any contract that yields the shareholders an expected *equilibrium* profit of  $\underline{\pi}$ . An expected profit less than  $\underline{\pi}$  will be rejected by the shareholders (the forms such a rejection could take include selling the firm or a proxy fight to replace management or veto the compensation package). Thus, if  $s_1$  is the executive's salary when gross profits are  $x_1$ , then any contract  $s = (s_1, \dots, s_n)'$  must satisfy  $p'(x - s) \geq \underline{\pi}$ , or, rewriting,

$$p's \leq p'x - \underline{\pi}. \quad (1)$$

Note that the shareholders remain the residual claimants.

Since  $v(\cdot)$  is invertible, one can work either in terms of money ( $s$ ) or utility ( $u$ ). Thus, an alternative to specifying a contract as  $s$ , a vector of monetary payments, is to specify it as  $u$ , a vector of utilities over money, where the two vectors are related by  $s_1 = v^{-1}(u_1)$ .

### 3. Analysis of the Model

#### *Basic Analysis*

The shareholders' decision to accept a contract depends on which action they anticipate that contract will induce -- the  $p$  in (1) must be the executive's best response to the contract  $s$ :

$$\sum_{i=1}^n p_i v(s_i) - c(p) \geq \sum_{i=1}^n \hat{p}_i v(s_i) - c(\hat{p}), \quad \forall \hat{p} \in \mathcal{P}. \quad (2)$$

If (2) did not hold, then, given the contract, the executive would choose another action and, recognizing this, the shareholders would calculate their expected profit using this other action instead of  $p$ . If there exists a contract  $s$  such that (2) is met, then  $p$  is *implementable*. Let  $\mathcal{P}^I$  denote the set of all implementable actions.

The executive's objective is to maximize his expected utility subject to (1) and

(2). Imagine the executive solves this problem as follows. First, he derives for each implementable action the contract that maximizes his expected utility over money given that the contract is incentive compatible with that action and acceptable to the shareholders. Then, he chooses from all such contracts the one that maximizes his overall expected utility.<sup>9</sup> Thus, the first step is for each  $p^k \in \mathcal{P}^I$  solve

$$\max_u p^k, u \quad (3)$$

$$\text{subject to } p^k, u - c(p^k) \geq p', u - c(p), \forall p \in \mathcal{P}, \quad (3a)$$

$$\text{and } \sum_{i=1}^n p_1^k v^{-1}(u_i) \leq p^k, x - \underline{\pi}. \quad (3b)$$

Constraint (3b) must be binding in equilibrium (if it were not and  $u$  were the equilibrium contract, there would exist an  $\varepsilon > 0$ , such that  $\hat{u}$ , where  $\hat{u}_i = u_i + \varepsilon$ , satisfies (3a) and (3b)). Define  $u^k$  (alternatively  $s^k$ ) as the solution to (3). Define  $EU^k$  by

$$EU^k = p^k, u^k - c(p^k).$$

The second step is then to choose the element in  $\mathcal{P}^I$  that maximizes  $EU^k$ ; i.e., solve

$$\max_{p^k \in \mathcal{P}^I} EU^k. \quad (4)$$

If  $p^j$  is the solution to (4), then the executive offers  $u^j$ .

#### *Increased Competition in the Market for Corporate Control*

The parameter  $\underline{\pi}$  can be interpreted as a measure of the level of competition in the market for corporate control. For instance, consider a simple model in which

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<sup>9</sup> This procedure is analogous to a firm first deriving its cost function, then choosing how much to produce. This is the same procedure employed by Grossman and Hart (1983), except in their work the principal offers the contract and here the agent offers the contract.

target shareholders receive  $T(N)$ ,  $T'(N) > 0$ , for their shares when there are  $N$  (potential) raiders. For the shareholders not to tender their shares,  $\underline{\pi}/r \geq T(N)$ , where  $r$  is the interest rate. Thus, as  $N$  increases, so does  $\underline{\pi}$ . Alternatively, some, unspecified, bargaining game between the shareholders and the executive fixes  $\underline{\pi}$ . If the shareholders' bargaining position improves,  $\underline{\pi}$  increases.<sup>10</sup> The issue, then, is what happens when  $\underline{\pi}$  increases?

The answer comes from recognizing that, for a small increase in  $\underline{\pi}$ , the decrease in  $EU^k$  is approximately the shadow price of  $\underline{\pi}$  in the program (3), which is the Lagrange multiplier on (3b),  $\mu^k$ . That is,  $dEU^k/d\underline{\pi} = -\mu^k$ . It follows that if the executive initially prefers  $p^h$  to  $p^j$  (i.e.,  $EU^h \geq EU^j$ ) and  $\mu^h < \mu^j$ , then an increase in  $\underline{\pi}$  cannot cause the executive to prefer  $p^j$  to  $p^h$ . In particular, if  $\mu^k$  is decreasing in  $k$ , then a small increase in  $\underline{\pi}$  cannot cause the executive to switch from a harder action to an easier action. Moreover, if  $\mu^k$  is decreasing in  $k$  for all  $\underline{\pi}$ , then no increase in  $\underline{\pi}$  can cause the executive to switch from a harder action to an easier action. Conditions under which  $\mu^k$  is decreasing in  $k$  for all  $\underline{\pi}$  are given by the following proposition (the proof of which is in the appendix).

**Proposition 1:** *If any one of the following sets of conditions is met, then an increase in  $\underline{\pi}$  never leads the executive to take an easier action in equilibrium, but can lead him to take a harder action.*

- i)  $v(s) = \alpha \log_z (s + \gamma) + \beta$ , where  $\alpha, \beta, \gamma$ , and  $z$  are constants,  $\alpha > 0$ , and  $z > 1$ .
- ii)  $\frac{1}{v'(\cdot)}$  is convex and for all actions there exists an  $\eta^k \in [0,1]$  such that  $\eta^k p^m + (1-\eta^k)p^0 = p^k$  and  $\eta^k c(p^m) + (1-\eta^k)c(p^0) \leq c(p^k)$ , with equality only if  $k = 0$  or  $k = m$ .

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<sup>10</sup> See "Don't Tread on Us", *Business Week*, June 11, 1990, for anecdotal evidence on the increasing clout of activist shareholders.

iii)  $\frac{1}{v'(\cdot)}$  is convex;  $v(s) \rightarrow -\infty$  as  $s \rightarrow 0$ ; and the Arrow-Pratt measure of relative risk aversion for  $v(\cdot)$  is everywhere less than one.

Assuming that  $1/v'(\cdot)$  is convex is equivalent to assuming that  $v(\cdot)$  exhibits increasing, constant, or modestly decreasing absolute risk aversion (if  $A(\cdot)$  is the Arrow-Pratt measure of absolute risk aversion, then "modestly decreasing" means  $A'(s) \geq -[A(s)]^2$ ).

The assumption in (ii) implies that  $\mathcal{P}^I$  contains only two elements -- mixing over  $p^0$  and  $p^m$  dominates choosing  $p^k$  as a pure strategy -- so the result follows because the optimal incentive scheme for  $p^m$  exposes the executive to risk, while the optimal incentive scheme for  $p^0$  does not. Note (ii) applies, trivially, if there are only two actions. Except when there are only two profit levels, (ii) is an extremely stringent condition, since it requires that all the probability densities be convex combinations of just two densities.

The assumption in (iii) that  $v(s) \rightarrow -\infty$  as  $s \rightarrow 0$  is made to bound the set of feasible contracts. Any other bound would do as well. Since  $1/\mu^k = \sum_{i=1}^n p_i^k / v'(s_i^k)$  and  $1/v'(\cdot)$  is increasing, if one could ignore the (inconvenient) fact that the function of the expectation is not (generally) the expectation of the function, then the fact that  $\sum_{i=1}^n p_i^k s_i^k$  increases in  $k$  would be sufficient to guarantee that  $\mu^k$  is decreasing in  $k$ . The conditions in (iii) are sufficient conditions on the curvature of  $1/v'(\cdot)$  to allow us to "ignore" this inconvenient fact.<sup>11</sup>

The "likelihood" of the conditions in Proposition 1 is a matter of opinion. The log-utility function is a fairly flexible functional form -- more flexible than the infinite-risk-aversion utility functions that have been used previously in this

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<sup>11</sup> The reader may wonder if there is some clever assumption about stochastic dominance that would also deal with this inconvenient fact. The answer is no, because the relevant distributions are *endogenously* determined -- recall these are distributions over salaries (the  $s$ 's).

literature -- and may reasonably approximate reality. Condition (ii) is stringent, but it may, nonetheless, make sense in some settings. For example, if  $\eta$ ,  $\eta \in [0,1]$ , represents effort, if the density induced by  $\eta$  amount of effort is  $\eta\bar{p} + (1-\eta)p$ , where  $\bar{p}'x > p'x$ , and the cost of effort is concave,<sup>12</sup> then the second half of condition (ii) is satisfied. Since it is reasonable to assume that zero wealth yields extremely little utility, and the other conditions in (iii) are feasible (i.e., not mutually exclusive), there is no obvious reason for dismissing these conditions.

Intuition can be gained by considering the problem without moral hazard. Suppose the shareholders can perfectly monitor the executive, then the executive can commit to any action  $p$  by offering a contract that pays him  $p'x - \underline{\pi}$  if he undertakes  $p$ , and which pays him some arbitrarily small amount if he undertakes any other action. In this case, the executive will choose the  $p$  that maximizes

$$v(p'x - \underline{\pi}) - c(p).$$

Given the executive's diminishing marginal utility of income, as  $\underline{\pi}$  increases, the executive will never switch to an easier action, but he may switch to a harder action. In other words, absent incentive effects, easier actions are normal goods; hence, as his income declines, the executive "consumes less" of them.

The income effect arises, here, from diminishing marginal utility of income and additive separability between income and action. These, however, are not necessary conditions. Other utility functions can yield a similar income effect. This model's conclusions, therefore, do not depend on additive separability; they depend, instead, on easier actions (e.g., leisure and perquisites) being normal goods.

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<sup>12</sup> A concave cost of effort function is, admittedly, not the standard assumption. But it may make sense in some settings. For instance, the marginal opportunity cost of being at work may be decreasing with hours worked. A little time off at the end of the day, for example, may not be enough to do something worthwhile, while time off earlier in the day is. So having to work an additional hour on top of a, say, four-hour workday can be more costly than having to work an additional hour on top of an eight-hour work day.

When moral hazard is reintroduced, the executive's problem can be viewed as choosing the  $p^k$  that maximizes

$$v(p^k, x - \underline{\pi} - R^k(\underline{\pi})) - c(p^k), \quad (5)$$

where  $R^k(\underline{\pi})$  is the risk premium associated with the optimal contract for inducing  $p^k$ . From (5), an increase in  $\underline{\pi}$  has two effects: an income effect and a "risk-adjustment" effect. This second effect arises because increasing  $\underline{\pi}$  does more than reduce expected income -- for instance, the contract  $(s_1^k - \Delta\underline{\pi})$ , where  $\Delta\underline{\pi}$  is the increase in  $\underline{\pi}$ , may not be incentive compatible with action  $p^k$ , or, if it is incentive compatible, it may not be the optimal contract for inducing  $p^k$  under the new regime. If the income effect dominates the risk-adjustment effect, an increase in  $\underline{\pi}$  cannot induce the executive to choose an easier action. The conditions in Proposition 1 are each sufficient to ensure that the income effect dominates the risk-adjustment effect.

As noted in the introduction, this paper differs from previous papers in that, here, increased competition does not improve matters by changing the information structure. One might, however, wonder what would happen if increased competition did change the information structure. Although a complete analysis of this question lies outside the scope of this paper, the following seems clear. Assume increased competition makes gross profits (i.e., the  $x$ 's) more informative about the executive's action. As a general rule, this means that an incentive scheme has to be less risky in order to induce the executive to take a given action. In terms of (5), this is equivalent to a reduction in  $R^k(\underline{\pi})$  for all  $k$ . This, in turn, is equivalent to giving the executive more income. Since agency goods are normal goods, this change in information would tend to make the executive choose easier actions.<sup>13</sup> On the other hand, there may be a differential reduction in  $R^k(\underline{\pi})$  for different  $k$ , which

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<sup>13</sup> Note that this conclusion is the opposite of Hart (1983). As Section 4 will make clear, this is only one example of how giving the bargaining power to the executive can reverse the comparative statics relative to the classic model.

may reverse this tendency. In any case, this "information" effect is only one of many effects -- whether, or not, increased competition leads to harder actions depends on this effect's importance vis-à-vis the other effects' importance.

Proposition 1 only states that an increase in  $\underline{\pi}$  can lead the executive to choose a harder action. The following example shows this is not an idle possibility. It is also an example of how expected income can increase despite an increase in  $\underline{\pi}$ .

*Example:* Suppose there are two actions ( $p^0$  and  $p^1$ ) and two profit levels ( $x_1 = 4$  and  $x_2 = 33$ ). Suppose  $p^0 = (3/4, 1/4)'$  and  $p^1 = (1/4, 3/4)'$ . Suppose, initially, that  $\underline{\pi} = 4$ . Suppose  $c(p^0) = 0$  and  $c(p^1) = \ln(2)$ . Finally, suppose  $v(s) = \ln(s)$ . Then  $p^0 \cdot x = 15.25$  and  $p^1 \cdot x = 29.75$ . It is straightforward to show that if  $p^1$  is incentive compatible, then  $s_2 = 4s_1$ . Thus,  $s_1^1 = 103/13$  and  $s_2^1 = 412/13$ . Clearly,  $s_1^0 = s_2^0 = 45/4$ . Hence,  $EU^1 \approx 2.416$  and  $EU^0 \approx 2.420$ ; the executive will choose  $p^0$  and his expected income will be  $45/4$ . Suppose, now, that  $\underline{\pi}$  increases, so that  $\underline{\pi} = 5$ . Now  $s_1^1 = 99/13$  and  $s_2^1 = 396/13$ , while  $s_1^0 = s_2^0 = 41/4$ . Hence,  $EU^1 \approx 2.377$  and  $EU^0 \approx 2.327$ ; now, the executive will choose the harder action  $p^1$  and his expected income will be  $99/4$ . That is, an increase in  $\underline{\pi}$  from 4 to 5 causes the executive to choose a harder action and raises his expected income.<sup>14</sup>

#### *Increased Competition in the Product Market*

The above analysis also applies to product-market competition. For instance, suppose simply that the firm's gross profits were  $p \cdot x - \theta$ , where  $\theta$  is a measure of competition. Clearly,  $\theta$  plays the same role  $\underline{\pi}$  played above; if  $\mu^k$  is decreasing in  $k$ , increased competition (as measured by an additive shift) can never lead the

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<sup>14</sup> Although admittedly very simple, this example is surprisingly realistic with respect to the numbers: in this example, a 25% increase in profits corresponds to a 120% increase in expected income; in reality, a 31% increase in profits corresponded to a 128% increase in average income (from 1980 to 1988, see footnote 3 for details).

executive to take easier actions, but it can lead him to take harder actions.

Admittedly, this is a very reduced-form model of competition.<sup>15</sup> Its virtue is that, by leaving the information structure unaffected, it does not change the set of implementable actions. Moreover, the effects of competition are uniform across the different actions. That is, competition does not directly bias the executive toward harder or easier actions.

As an alternative to additive shifts, multiplicative shifts may be a better approximation of reality -- suppose that the  $i$ th profit level is  $h(N)x_i$ , where  $h(N)$  is a decreasing differentiable function of the number of firms,  $N$ , in the industry.<sup>16</sup> It is straightforward to show that

$$\frac{dEU^k}{dN} = h'(N)\mu^k p^{k'} x.$$

Thus, if  $\mu^k p^{k'} x$  is decreasing in  $k$ , increased competition cannot lead the executive to take easier actions. As an example of this, suppose  $v(s) = \log_z(s)$  ( $z > 1$ ), then

$$\mu^k p^{k'} x = \frac{p^{k'} x}{\ln(z)[h(N)p^{k'} x - \underline{\pi}]},$$

which is decreasing in  $k$ .<sup>17</sup>

The requirement that  $\mu^k p^{k'} x$  decrease in  $k$  is clearly more stringent than the requirement that  $\mu^k$  decrease in  $k$ : Unlike the previous analysis, here, there is an additional "diminished-profitability" effect -- as  $N$  increases, the profitability of

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<sup>15</sup> One set of assumptions that would yield this formulation is that the firms in an oligopoly are able to collude at the monopoly price,  $w$ ; that the production technology exhibits constant marginal cost,  $g$ ; and that the demand is  $q_1 = \beta_1 - f(N)$ , where the distribution of  $\beta$  is dependent on the executive's action (e.g., promotional activity) and  $f(N)$  ( $= \theta/(w-g)$ ) is an increasing function of the number of firms,  $N$ . A similar set of assumptions is that retail price,  $w$ , and the wholesale price,  $g$ , are set by an upstream monopolist and that  $q_1$  is, as above, determined by the executive's promotional activities and the number of competitors.

<sup>16</sup> For example,  $h(N)$  could be the number of customers the firm attracts and  $x_i$  is the profit per customer in the  $i$ th state.

<sup>17</sup> For the derivation of  $\mu^k$  in this case, see the proof of Proposition 1.



any action,  $p$ , decreases by  $h'(N)p'x$ . Thus, the difference in profitability between a hard action and an easy action is decreasing, which makes the the hard action relatively less desirable. As this discussion suggests, it is *a priori* ambiguous as to whether the income effect dominates or is dominated by the diminishing-profitability effect.

#### 4. Comparison with the Classic Principal-Agent Model

Unlike the model explored so far, the classic principal-agent model assumes the principal has all the bargaining power. To see the importance of this difference, consider the consequence of an increase in competition (an increase in  $\theta$ ) under the classic model. Let  $C(p)$  represent the shareholders' cost of implementing action  $p$  under the optimal incentive scheme when they have the bargaining power. Then their problem is

$$\max_{p \in \mathcal{P}^I} p'x - \theta - C(p).$$

Clearly, the solution is independent of  $\theta$ . Thus, under the classic model, an increase in the level of competition changes neither the executive's action, nor his expected income ( $C(p)$ ).

The classic model and the model of Section 2 can also yield different predictions with multiplicative shifts. To see this, recognize that the shareholders' problem is

$$\max_{p \in \mathcal{P}^I} h(N)p'x - C(p).$$

As  $N$  increases, the shareholders will never wish to implement a harder action; this follows from

**Lemma:** Consider the classic principal-agent model with multiplicative shifts. Let  $N_1 > N_0$ . If it is optimal for the shareholders to induce  $p$  when there are  $N_0$  firms, and  $\hat{p}$  when there are  $N_1$  firms, then  $p$  is a harder action than  $\hat{p}$ . Moreover, the cost of implementing  $\hat{p}$ ,  $C(\hat{p})$ , is less than the cost of implementing  $p$ ,  $C(p)$ .

**Proof:** By assumption,

$$h(N_0)p'x - C(p) \geq h(N_0)\hat{p}'x - C(\hat{p})$$

and

$$h(N_1)p'x - C(p) \leq h(N_1)\hat{p}'x - C(\hat{p}). \quad (6)$$

These inequalities imply

$$h(N_0)(p'x - \hat{p}'x) \geq h(N_1)(p'x - \hat{p}'x),$$

which, since  $h(\cdot)$  is a decreasing function, implies

$$p'x - \hat{p}'x > 0. \quad (7)$$

Since an action is harder if and only if it produces greater gross monetary profits, the first part of the lemma follows. Rearranging (6), yields

$$h(N_1)(p'x - \hat{p}'x) \leq C(p) - C(\hat{p}),$$

which, by (7), implies  $C(p) > C(\hat{p})$ . ■

On the other side, if the executive has the bargaining power, then, provided  $v(s) = \log_2(s)$ , an increase in  $N$  will never lead the executive to choose an easier action. This proves the following proposition:

**Proposition 2:** Assume increased product market competition changes gross profits by a multiplicative factor,  $h(N)$ , where  $h(N)$  is a differentiable decreasing function of the number of firms,  $N$ . Then, if the shareholders have the bargaining power, an increase in the number of firms cannot lead them to induce a harder action, but can lead them to induce an easier action. Furthermore, the executive's expected income cannot increase as the number of firms increases. In contrast, if the executive's

utility function over income,  $s$ , is  $\log_z(s)$  and he has the bargaining power, an increase in the number of firms cannot lead him to choose an easier action, but can lead him to choose a harder action. Furthermore, the executive's expected income can increase as the number of firms increases.

The difference in the response by shareholders and the executive to changes in product-market competition is due to the differences in their income effects. For the shareholders there is no income effect. Thus, with an additive shift, there is no force working on them to make them change the action they induce. With a multiplicative shift, the diminished-profitability effect is the only force working on the shareholders; hence, they may induce an easier action.

A second question to consider is whether the executive works harder when he has the bargaining power or when the shareholders have it. Intuitively, the answer might seem unclear: on the one hand, when he has the bargaining power, the executive has greater freedom to be lazy; on the other hand, because he captures more of the profits he produces, the executive may have a stronger incentive to work hard. Formally, let  $\pi^*$  be the shareholders' expected equilibrium profit when they have the bargaining power and let  $\pi_0$  be their expected equilibrium (reservation) profit when they do not. The incentive compatibility constraints, (2), are independent of who has the bargaining power. Consequently, from duality, the optimal contract for the shareholders to offer when they have the bargaining power is the same contract that the executive would offer if he had the bargaining power and  $\underline{\pi} = \pi^*$ . Since (obviously)  $\pi^* \geq \pi_0$ , if  $\mu^k$  is decreasing in  $k$ , the executive works at least as hard when the shareholders have the bargaining power as he does when he has the bargaining power. To summarize

**Corollary to Proposition 1:** *If any one of the sets of conditions in Proposition 1 is met, then the executive works at least as hard when the shareholders have the*

*bargaining power as he does when he has the bargaining power.*

The Corollary is broadly consistent with empirical studies. For instance, Hannan and Mavinga (1980) find that management-controlled banks spend significantly more on furniture and offices than owner-controlled banks (remember that, here, perquisite taking is equivalent to not working hard). They find, however, that wages and salaries are not significantly greater. This last finding is not inconsistent with the Corollary: the fact that the managers work harder in a owner-controlled bank tends to push up their salaries versus a management-controlled bank; on the other hand, because they do not have control, they can capture less of the rents -- the net effect of control on salaries is, thus, ambiguous.

## 5. Conclusion

This paper has provided some theoretical support for the widely held belief that increased competition, either in the product market or in the corporate control market, can cause an executive to work harder. The crucial assumption behind this result is that the executive has the bargaining power.

The "classic" principal-agent model, in which the shareholders have the bargaining power, yields quite different results. For simple models of product market competition, the classic model predicts either that increased competition will have no effect on the executive's behavior, or it can lead him to take *easier* actions.

Many of the results derived here depend on agency goods (e.g., slacking, perquisites, empire building, etc.) being normal goods for the executive. The reader may not believe that income effects are the channel through which the invisible hand disciplines executives. Even with this doubt, the paper contains a useful insight about principal-agent models: which party has the bargaining power matters for more than who gets the rents -- these models' comparative statics also depend on who has

the bargaining power. As shown here, reversing who has the bargaining power can reverse the effects of changes in the competitive environment on executive behavior.

#### Appendix: Proof of Proposition 1

First, a lemma

$$\text{Lemma A.1: } \mu^k = \left( \sum_{i=1}^n p_i^k \frac{1}{v'(s_1^k)} \right)^{-1}.$$

*Proof of Lemma:* Solving (3), yields the first-order condition:<sup>18</sup>

$$p_1^k + \lambda_j (p_1^k - p_1^j) - \mu^k p_1^k \frac{1}{v'(s_1^k)} = 0, \forall j \neq k \quad (\text{A.1})$$

( $\lambda_j$  is the Lagrange multiplier on (3a) for action  $p^j$ ). Summing (A.1) over  $i$  yields

$$1 = \mu^k \sum_{i=1}^n p_i^k \frac{1}{v'(s_1^k)}.$$

■

*Proof of (i):*  $\frac{1}{v'(s)} = (s+\gamma)\ln(z)/\alpha$ , so the result follows since (3b) is binding and  $p^k, x$  is increasing in  $k$ .

*Proof of (ii):*

**Lemma A.2:** *If  $\mathcal{P}^I$  contains only two actions and  $1/v'(\cdot)$  is convex, then  $\mu^k$  is decreasing in  $k$ .*

*Proof of Lemma:* Since a full-insurance contract (optimally) implements it,  $p^0 \in \mathcal{P}^I$  and  $s_1^0 = p^0, x - \underline{\pi}$ ,  $\forall i$ . So,

<sup>18</sup> The maximand is weakly concave, while the constraints (3a) are weakly convex and the constraint (3b) is strictly convex. Thus, the first-order conditions are sufficient as well as necessary.

$$\sum_{i=1}^n p_i^0 \frac{1}{v'(s_i^0)} = 1/v' \left( \sum_{i=1}^n p_i^0 s_i^0 \right).$$

Let the other element of  $\mathcal{P}^I$  be denoted by  $\mathbf{p}^+$ . By Jensen's inequality,

$$\sum_{i=1}^n p_i^+ \frac{1}{v'(s_i^+)} \geq 1/v' \left( \sum_{i=1}^n p_i^+ s_i^+ \right).$$

Since  $1/v'(\cdot)$  is an increasing function, the result follows since (3b) is binding. ■

From Proposition 2 of Hermalin and Katz (1990), only  $\mathbf{p}^m$  and  $\mathbf{p}^0$  are implementable.

Thus, (ii) follows from Lemma A.2.

*Proof of (iii)*

**Lemma A.3:** For all  $y$  and  $z$ ,  $\frac{y}{v'(z/y)}$  is increasing in  $y$  if the measure of relative risk aversion for  $v(\cdot)$  is everywhere less than one.

*Proof of Lemma:* It is straightforward to show that the sign of the derivative of

$\frac{y}{v'(z/y)}$  is the same as the sign of

$$v' \left( \frac{z}{y} \right) + \frac{z}{y} v'' \left( \frac{z}{y} \right). \quad (\text{A.2})$$

Rearranging (A.2), it is clear that (A.2) is positive if

$$\frac{-wv''(w)}{v'(w)}$$

is less than one for all  $w$ . The result follows. ■

**Lemma A.4:** If  $\frac{1}{v'(\cdot)}$  is convex,  $v(s) \rightarrow -\infty$  as  $s \rightarrow 0$ , and for all  $k$  and  $j$ ,  $j < k$ ,

$$\max_i \frac{p_i^j}{v' \left( \frac{p_i^j \mathbf{x} - \underline{\pi}}{p_i^j} \right)} \leq \frac{1}{v' \left( \mathbf{p}^k \mathbf{x} - \underline{\pi} \right)}.$$

then  $\mu^k$  is decreasing in  $k$ .

*Proof of Lemma:* Since  $v(s) \rightarrow -\infty$  as  $s \rightarrow 0$ , equilibrium contracts must specify  $s_i > 0$ , for all  $i$ . Since  $v(\cdot)$  is strictly increasing, it must be that  $1/v'(s) \rightarrow 0$  as  $s \rightarrow 0$ .

Since  $1/v'(\cdot)$  is convex, the contract that optimally implements  $\mathbf{p}^j, \mathbf{s}^j$ , satisfies

$$\sum_{i=1}^n p_i^j \frac{1}{v'(s_i^j)} < \max_i \frac{p_i^j}{v' \left( \frac{p_i^j}{\mathbf{p}^j, \mathbf{x} - \bar{\pi}} \right)}.$$

For the same reason, the contract that optimally implements  $\mathbf{p}^k, \mathbf{s}^k$ , satisfies

$$\sum_{i=1}^n p_i^k \frac{1}{v'(s_i^k)} \geq \frac{1}{v'(\mathbf{p}^k, \mathbf{x} - \bar{\pi})}.$$

The result follows. ■

Since  $1/v'(\cdot)$  is an increasing function,

$$\frac{1}{v'(\mathbf{p}^k, \mathbf{x} - \bar{\pi})} \geq \frac{1}{v'(\mathbf{p}^j, \mathbf{x} - \bar{\pi})}, \quad \forall \bar{\pi}.$$

Since the measure of relative risk aversion is assumed to be less than one everywhere, it follows, then, from Lemma A.3, that

$$\frac{1}{v'(\mathbf{p}^j, \mathbf{x} - \bar{\pi})} \geq \frac{p_i^j}{v' \left( \frac{p_i^j}{\mathbf{p}^j, \mathbf{x} - \bar{\pi}} \right)}, \quad \forall p_i^j \in \mathbf{p}^j \text{ and } \forall \bar{\pi}.$$

The result then follows from Lemma A.4. ■

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