Università degli Studi Firenze
DISEI
Dipartimento di Scienze per l'Economia e l'Impresa

Working Papers – Economics

Moral Hazard and Competitive Paradoxes

Federico Etro

Working Paper N. 16/2026

DISEI, Università degli Studi di Firenze
Via delle Pandette 9, 50127 Firenze (Italia)
www.disei.unifi.it

Moral Hazard and Competitive Paradoxes

Federico Etro[1]

University of Florence

Abstract

We study moral hazard by managers engaged in cost-reducing activities under incentive contracts à la Holmstrom-Milgrom and monopolistic competition. Moral hazard affects both managerial incentives and market structure, generating potential paradoxes. The main one is that moral hazard can increase equilibrium effort and reduce prices by discouraging entry and expanding firm scale. Alternatively, it can foster entry by relaxing incentive contracts and reducing fixed costs of managerial compensation. We analyze equilibria under general cost and demand functions, and compare equilibrium and optimal effort and entry for CES, Logit and Linear demand systems.

Key words: Managerial compensation, moral hazard, incentive mechanisms, Holmstrom-Milgrom model.

JEL Code: L1, L4.

[1] I am grateful to Paolo Bertoletti for insightful discussions on the topic. *Correspondence*. Federico Etro: Florence School of Economics and Management, Via delle Pandette 32, Florence, 50127. Phone: 055-2759603. Email: *federico.etro@unifi.it*.

In an isolated principal-agent relation, moral hazard reduces effort exerted by the agent and benefits created for the principal. This may suggest that, under competition between principals, moral hazard would reduce effort of agents and entry of principals. We analyze this issue in a monopolistic competition model *à la* Spence (1976) between firms with managers engaged in cost-reducing investment and subject to a moral hazard problem *à la* Holmstrom and Milgrom (1991). Firms set payment schemes that trade off managerial incentives and insurance and compete in prices as in Raith (2003). Moral hazard or less accurate information and higher risk can reduce effort and entry, but we show that different and paradoxical results can also emerge. The main one is that moral hazard can induce all managers to increase their effort in cost reduction and therefore reduce prices. Alternatively, moral hazard can foster entry of firms in spite of lower effort and higher prices. The intuition relies on different competitive effects. When moral hazard reduces entry, the sales of the remaining firms can increase enough to incentivize a higher investment in cost reduction through a strengthening of the incentive mechanisms. Instead, when moral hazard reduces effort, the effective cost of entry and managerial compensation can decrease enough to attract more firms in the market.

The economic literature has emphasized a variety of paradoxes that are related to our *effort-increasing moral hazard.* For instance, in the Giffen paradox the demand of a good increases with its price when a substitution effect is compensated by an income effect, while in the Metzler paradox the price of an imported good decreases with the tariff when a partial equilibrium effect is compensated by a general equilibrium effect. Our paradox emerges when a cost effect due to the moral hazard distortion is compensated by a competitive effect due to entry. Instead, the paradox of *entry-increasing moral hazard* emerges when the distortion diverts investment in cost reduction toward investment in entry, as an example of the principle of second best.

These results can be relevant to understand the relation between risk and performance pay. While the standard principal-agent model predicts a negative relation, the empirical literature has not systematically found a significant or even negative relation between risk and the power of incentive contracts (Prendergast, 2002). A positive relation between risk and performance pay has been explained in the presence of agents who are heterogeneous in risk aversion and principals who are heterogeneous in risk, so that assortative matching can associate higher risk with less risk aversion (Serfes, 2005). This can be relevant to explain a positive correlation between risk and incentive intensity across sectors. Here we offer an alternative explanation that works also for identical agents and patrons, and is based on competition mechanisms within a market. This can explain a positive correlation also within sectors.

We initially develop the analysis through an example based on power specifications and CES preferences. In this case we also show that the equilibrium effort does not change with market size and is socially optimal, while entry is insufficient from a social planner perspective. Then, we generalize the analysis to a more general disutility and cost functions and demand systems. Under a demand microfoundation developed in Bertoletti and Etro (2024), which nests the CES example and other commonly used demand models, we characterize the equilibrium incentive contracts and derive conditions for the emergence of the paradoxical results. In this environment the equilibrium effort does not change with market size, but can be either above or below the socially optimal level. We illustrate the analysis with a Logit demand example that provides a case of entry-increasing moral hazard where both effort and entry are efficient. Finally, we relate to models where a larger market size is associated with steeper incentive mechanisms and effort, as in the spatial competition model of Raith (2003). We do so by presenting a linear demand example based on a microfoundation developed in Bertoletti and Etro (2025). This provides another case of entry-increasing moral hazard, but leads to underprovision of effort and excess entry.

Other works have emphasized how market structure affects managerial incentives under moral hazard; a notable case is Anton *et al.* (2022), whose focus, however, is on the impact of common ownership. Works by Piccolo (2011) and de Pinto, Goerke and Palermo (2023) have explored the impact of asymmetric information on the productivity of heterogeneous managers in imperfectly competitive markets. In a similar spirit Bertoletti and Etro (2026) study monopolistic competition between firms with heterogeneous managers engaged in cost reducing investments under power specifications and CES preferences, endogenizing both entry and selection of firms. In that case, informational frictions induce only the most efficient firms to increase investments in cost reductions, and the distribution of managers' types determines whether selection and entry are excessive or insufficient compared to a constrained social optimum. All these works contribute to explore how informational frictions affect monopolistic competition and could be used in trade and macroeconomic applications.

1 An Holmstrom-Milgrom model with monopolistic competition

Let us consider n firms. Each firm i employs a manager to produce a differentiated good sold at price p_i. When the manager exerts effort e_i with disutility:

$$g(e_i) = \frac{e_i^{1+\gamma}}{1+\gamma}$$

the marginal cost of production becomes:

$$c(e_i) = e_i^{-m}$$

where $\gamma > 0$ represents the elasticity of marginal disutility and $m > 0$ the elasticity of the marginal cost with respect to effort. Each principal-firm pays a wage w_i to its manager-agent.

Firms are engaged in monopolistic competition. We follow the classic model of Spence (1976) in partial equilibrium and consider L identical consumers with a demand system derived from CES preferences with elasticity $\varepsilon > 1$ according to:

$$q(p_i, A) = \frac{(\varepsilon - 1)p_i^{-\varepsilon}}{A}$$

where:

$$A=\sum_{j=1}^{n}p_j^{1-\varepsilon}$$

is a standard price aggregator. The gross profits of each firm are:

$$\Pi_i=[p_i-c(e_i)]\,q(p_i,A)L-w_i$$

The number of principals is determined endogenously by a zero profit condition equating these profits to the entry cost F.

We follow Holmstrom and Milgrom (1991) and assume that effort is not observable, but each principal observes a stochastic variable:

$$R_i=e_i+\varsigma$$

where ς is a normally distributed shock with zero expectation and variance σ^2, which is an inverse measure of the accuracy of the information on managerial effort. The manager of firm i is paid:

$$w_i=\bar{w}_i+\chi_i R_i$$

where $\bar{w}_i$ is a fixed wage and χ_i measures the intensity of incentives. Under exponential utility with unitary absolute risk aversion, the expected utility of the manager corresponds to:

$$U_i=\bar{w}_i+\chi_i e_i-g(e_i)-\frac{\chi_i^2\sigma^2}{2}$$

where the last term represents the cost of uncertainty. The outside option has a null value. Given the incentive contract of firm i its manager selects effort according to the incentive compatibility condition:

$$g'(e_i)=\chi_i$$

which defines an effort function increasing in χ_i.

Each principal i chooses the contract anticipating the manager's optimal effort. Therefore, it sets the fixed wage to satisfy the participation constraint and selects incentive intensity χ_i and price p_i to maximize profits. Since incentives can be designed to induce the agent to select the desired effort under the incentive compatibility condition, the principal effectively selects (e_i, p_i) to maximize:

$$\Pi_i = [p_i - c(e_i)]\, q(p_i, A)L - \frac{g'(e_i)^2\sigma^2}{2} - g(e_i) \tag{1}$$

taking as given the price aggregator A, as customary under monopolistic competition.

Under our functional forms, the profit-maximizing price is given by a constant markup on the marginal cost:

$$p(e) = \frac{\varepsilon e^{-m}}{\varepsilon - 1}$$

This defines the following profit function for each firm depending on effort:

$$\Pi(e) = \left[p(e) - e^{-m}\right] \frac{(\varepsilon - 1)p(e)^{-\varepsilon}L}{A} - \frac{e^{2\gamma}\sigma^2}{2} - \frac{e^{1+\gamma}}{1+\gamma}$$

By the Envelope Theorem on the price impact, the marginal profit of effort can be expressed as:

$$\Pi'(e) = me^{-m-1}\frac{(\varepsilon - 1)p(e)^{-\varepsilon}L}{A} - \gamma e^{2\gamma-1}\sigma^2 - e^{\gamma}$$

An interior equilibrium effort e^e must satisfy $\Pi'(e^e) = 0$ where $\Pi''(e^e) < 0$. We assume $m(\varepsilon - 1) < 1 + \gamma$, which insures the existence of such an equilibrium in the absence of moral hazard ($\sigma^2 = 0$). Imperfect observability of effort ($\sigma^2 > 0$) increases the marginal cost of the incentive mechanism and reduces the equilibrium level of effort for any given A. This is the traditional effort-reducing effect of moral hazard.

Since profit is decreasing with entry, through its impact on the aggregator, under free entry the number of firms n^e and the corresponding aggregator $A^e = n^e p(e^e)^{1-\varepsilon}$ increase until profits are null and:

$$n^e = \frac{(\varepsilon - 1)L}{\varepsilon \tilde{F}(e^e)} \tag{2}$$

where:

$$\tilde{F}(e) = F + g(e) + \sigma^2\frac{g'(e)^2}{2}$$

is the effective entry cost, accounting for the manager's compensation.

Replacing in the marginal profit, we obtain:

$$\Pi'(e) = \frac{m(\varepsilon-1)F}{e} + \left[\frac{m(\varepsilon-1)}{2} - \gamma\right]\sigma^2 e^{2\gamma-1} + \left[\frac{m(\varepsilon-1)}{1+\gamma} - 1\right]e^{\gamma}$$

and the interior equilibrium must satisfy $\Pi'(e^e) = 0$.

In the absence of moral hazard (namely for $\sigma^2 = 0$) this implies:

$$e^e = \left[\frac{m(\varepsilon-1)(1+\gamma)F}{1+\gamma-m(\varepsilon-1)}\right]^{\frac{1}{1+\gamma}} \quad \text{and} \quad n^e = \frac{(\varepsilon-1)\left[1-\frac{m(\varepsilon-1)}{1+\gamma}\right]L}{\varepsilon F}$$

where an increase in market size L attracts entry proportionally and leaves unchanged the scale of each firm and therefore its incentive mechanism, effort and price. In the presence of moral hazard the equilibrium effort remains independent from the market size. Therefore, and in contrast with the model of Raith (2003), a larger market creates pure gains from variety without affecting managerial incentives and prices. However, moral hazard affects both effort and the number of firms, which is our main interest.

The comparative statics of equilibrium effort implies:

$$\frac{d\ln e^e}{d\ln\sigma^2} = \frac{[m(\varepsilon-1)-2\gamma]\,\sigma^2}{2\left|\Pi''(e^e)\right|(e^e)^{1-2\gamma}} \tag{3}$$

whose sign can be positive when the elasticity of the marginal disutility of effort γ is less than unitary (since the assumption $m(\varepsilon-1) < 1+\gamma$ is consistent with $m(\varepsilon-1) > 2\gamma$).

When $\gamma \in (0,1)$ there is a region of parameters such that $2\gamma < m(\varepsilon-1) < 1+\gamma$ where the introduction of moral hazard increases effort and therefore reduces cost and price of each firm. The intuition for this paradox emerges after realizing that moral hazard exerts two effects in this environment. One is the traditional effect of disincentivizing effort for a given number of firms because the incentive mechanisms are more costly under moral hazard. The other works in the opposite direction, because moral hazard disincentivizes entry and leaves fewer and larger firms in the market, which strengthens the incentives to promote effort in cost reductions applied on a larger scale. When the cost of the incentives is low compared to the return on investment in terms of additional sales, each firm sets a steeper incentive intensity when the available information becomes less precise (σ^2 increases). As an example, with $\varepsilon = 2$, $m = 1$ and $\gamma = 1/3$ we obtain:

$$e^e = \left(\frac{\sigma^2 + \sqrt{\sigma^4 + 36F}}{3}\right)^{\frac{3}{2}} \quad \text{and} \quad n^e = \frac{3L}{24F + 2\sigma^4 + 2\sigma^2\sqrt{\sigma^4 + 36F}}$$

where effort increases with variance and the number of firms decreases with it.[2]

When $m(\varepsilon - 1) < 2\gamma$, instead, the traditional effect is dominant and moral hazard induces all firms to soften their incentive mechanisms and increase costs and prices, which of course contributes to harm consumers. And consumers can be also harmed by less variety when moral hazard decreases profitability and leads to the exit of firms. However, this is not necessarily the case, and moral hazard can leave unchanged or even increase the number of firms, as we will now see.

When $\gamma = 1$, namely in the case of a quadratic disutility of effort, we can compute the equilibrium values:

$$e^e = \sqrt{\frac{2m(\varepsilon - 1)F}{[2 - m(\varepsilon - 1)](1 + \sigma^2)}} \quad \text{and} \quad n^e = \frac{(\varepsilon - 1)\left[1 - \frac{m(\varepsilon - 1)}{2}\right]L}{\varepsilon F}$$

so that effort decreases with moral hazard, but the number of firms is independent from it. In this knife-edge case moral hazard harms consumers through higher prices, but has no impact on the number of varieties provided by the market.[3]

The comparative statics of the number of firms implies:

$$\frac{d\ln n^e}{d\ln \sigma^2} = \frac{(\gamma - 1)\sigma^2 (e^e)^{3\gamma - 1}}{\tilde{F}(e^e)\,|\Pi''(e^e)|} \gtrless 0 \quad \text{if} \quad \gamma \gtrless 1 \tag{4}$$

therefore another paradoxical result can emerge. As long as the elasticity of the marginal disutility is high enough, namely for $\gamma > 1$, moral hazard fosters entry

[2] In the knife-edge case where $\gamma = m(\varepsilon - 1)/2 < 1$ the equilibrium effort is actually independent from variance and fixed at $e^e = \left[\frac{2\gamma(1+\gamma)F}{1-\gamma}\right]^{\frac{1}{1+\gamma}}$.

[3] Bertoletti and Etro (2026) have explored the case of heterogeneous managers with a different form of informational friction, emphasizing further effects on selection and number of firms depending on the productivity distribution. In that case, informational frictions induce only the most efficient firms to increase investments.

of firms. Here the intuition is that moral hazard reduces so much effort and wages that the effective fixed costs of entry and managerial compensation are reduced attracting more firms in the market. In practice, imperfect observability of effort diverts investments from cost reduction toward entry.

It is important to remark that these paradoxes are not due to gains from uncertanty or to inefficient choices of effort. In this model an increase of variance reduces both consumer welfare and total welfare. Nevertheless, the effort choice is the same that would be selected by a social planner constrained by imperfect observability of effort. To verify this, let us maximize total welfare:

$$W = L \log A + \sum\nolimits_j (\Pi_i - F + U_i)$$

with respect to price, effort and number of firms under the incentive compatibility constraint. Assuming symmetry and adopting marginal cost pricing, the social planner problem becomes:

$$\max_{(e,n)} W = L \log nc(e)^{1-\varepsilon} - n \left[F + \frac{e^{1+\gamma}}{1+\gamma} + \frac{\sigma^2 e^{2\gamma}}{2} \right]$$

The first order conditions can be combined to obtain the number of firms:

$$n^* = \frac{L}{\tilde{F}(e^*)} \tag{5}$$

with $e^* = e^e$. Accordingly, a social planner selects a larger number of firms compared to the market, confirming the insufficient entry result of Spence (1976), but it selects the same effort in cost-reducing activities. Such a result is confirmed in a model with heterogeneous firms subject to asymmetric information on the productivity of agents (see Bertoletti and Etro, 2026).

2 More general microfoundations

In this section we extend the analysis to more general microfoundations for the profit function (1). On the supply side we consider an effort choice $e_i \in [0, \bar{e}]$ for a large enough $\bar{e} > 0$ with a general disutility function $g(e)$ with:

$$g'(e) > 0 \quad \text{and} \quad g''(e) > 0$$

and a marginal cost function $c(e)$ with:

$$c'(e) < 0 \quad \text{and} \quad c''(e) \geqslant 0$$

where $c(\bar{e}) \to 0$. On the demand side the price aggregator can take different forms and affect $q(p_i, A)$ in various ways.

Following Bertoletti and Etro (2024), we start by considering a demand system derived from quasi-linear preferences represented by the indirect utility:

$$V = H\left(A\right) + E$$

where E is income, $H(A)$ is an increasing and strictly concave transformation function of the price aggregator:

$$A = \sum_{j=1}^{n} v(p_j)$$

and $v(p)$ is a surplus function with $v'(p) < 0$ and $v''(p) > 0$. By Roy's identity, this delivers the demand system:

$$q(p_i, A) = \left|v'\left(p_i\right)\right| H'(A) \tag{6}$$

which depends on the own price and the aggregator in a multiplicative way. Our leading example was based on $H(A) = \log A$ and $v(p) = p^{1-\varepsilon}$ with $\bar{e} \to \infty$.

Here we define the transformation elasticity $\rho(A) = -H''(A)A/H'(A) > 0$, the surplus elasticity $\zeta(p) = -v'(p)p/v(p) > 0$, the demand elasticity $\varepsilon(p) = -v''(p)p/v'(p) > 1$, the ratio $\eta(p) = \varepsilon(p)/\varsigma(p) \geqslant \rho(A)$,[4] and finally the cost elasticities $m(e) = -c'(e)e/c(e) > 0$ and $\gamma(e) = g''(e)e/g'(e) > 0$. A free entry equilibrium involves the standard price rule $p(e)$ such that:

$$p = \frac{\varepsilon(p)c(e)}{\varepsilon(p) - 1},$$

a number of firms implicitly defined by:

$$n^e = \frac{H'(A)AL}{\eta(p(e^e))\tilde{F}(e^e)} \tag{7}$$

[4] As shown in Bertoletti and Etro (2024) these preferences are convex under the condition $\eta(p) \geqslant \rho(A)$ in the case of homogeneous prices.

and an equilibrium effort defined by:

$$m(e^e)[\varepsilon(p(e^e)) - 1]\tilde{F}(e^e) = g'(e^e)e^e\left[1 + \sigma^2 g''(e^e)\right] \tag{8}$$

which confirms the independence of incentive mechanisms and prices from the size of the market.

Assuming a unique equilibrium, the impact of moral hazard on effort can be derived by total differentiation of the system (7)-(8) as:

$$\frac{d\ln e^e}{d\ln\sigma^2} \propto m(e^e)[\varepsilon(p(e^e)) - 1] - 2\gamma(e) \tag{9}$$

which generalizes our earlier result under variable elasticities. The paradox of effort-increasing moral hazard emerges when the cost of incentives is low compared to demand and cost elasticities.

Similarly, the impact on the number of firms can be derived as:

$$\frac{d\ln n^e}{d\ln\sigma^2} \propto -\frac{g'(e^e)^2\sigma^2}{2\tilde{F}} + \frac{d\ln e^e}{d\ln\sigma^2}\left\{-\frac{\partial\ln\tilde{F}(e)}{\partial\ln e} + \left[\frac{\partial\ln\eta(p)}{\partial\ln p} - \varsigma(p)[1-\rho(A)]\right]\frac{\partial\ln p}{\partial\ln e}\right\} \tag{10}$$

whose sign is also ambiguous. We can isolate four distinct effects of the introduction of moral hazard on entry. The first effect is always negative, because moral hazard increases the effective entry cost by requiring higher spending for a given investment. The other effects depend on the impact on effort, and we can exemplify them when effort decreases with variance. For given prices, the effect of moral hazard on entry is positive due to the reduction of the investment in cost reduction, and it can more or less than compensate the first effect. The last two effects operate through changes of prices. For a given aggregator, moral hazard affects profitability through changes of the ratio of demand and surplus elasticities $\eta(p)$, which may go in either direction. Finally, moral hazard affects profitability through changes in the aggregator, whose direction depends on the sign of $1-\rho(A)$. In our leading example each one of the first two effects can be dominant, while the last two effects were muted (since $\eta(p)$ was a constant and $\rho(A) = 1$).

We can explore the constrained-efficient allocation also in this environment.

In this case welfare is:

$$W = LV + \sum\nolimits_j (\Pi_i - F + U_i)$$

and the social planner problem:

$$\max_{(e,n)} LH\left[nv(c(e))\right] - n\left[F + g(e) + \sigma^2 \frac{g'(e)^2}{2}\right]$$

replicates the formula for the number of firms in (5), which differs from the equilibrium formula (7) due to the absence of the ratio of surplus and demand elasticities. Moreover, optimality requires an effort level satisfying:

$$m(e^*)\zeta(c(e^*))\tilde{F}(e^*) = g'(e^*)e^*\left[1 + \sigma^2 g''(e^*)\right] \tag{11}$$

which differs from the equilibrium version (8) for the surplus elasticity evaluated at the marginal cost. For preferences featuring a constant ratio of surplus and demand elasticity, equilibrium and optimal effort are identical, as was the case in our leading example,[5] while entry is weakly insufficient. Otherwise various inefficiencies in effort and entry can materialize.

2.1 A Logit demand system

An interesting example of our setup is represented by a version of the Logit demand system without outside option, that emerges when $H(A) = \log A$ and $v(p) = e^{-\lambda p}$, so that the demand is:

$$q(p, A) = \frac{\lambda e^{-\lambda p}}{A}$$

Let us adopt a quadratic disutility with $\gamma = 1$ and a linear marginal cost $c(e) = \bar{e} - e$. Assuming an interior solution, each manager sets effort according to $e_i = \chi_i$. Then, each firm i expects the following profits:

$$\Pi_i = (p_i - \bar{e} + e_i)\frac{\lambda \exp(-\lambda p_i)}{A}L - \frac{(1+\sigma^2)e_i^2}{2} - F$$

[5] This applies to a more general class of CRESS preferences characterized and discussed by Bertoletti and Etro (2024).

maximized by the conditions:

$$p = \bar{e} + \frac{1}{\lambda} - e$$

and:

$$e = \frac{\lambda L}{(1+\sigma^2)n}$$

The price decreases in the market size and increases in the number of firms due to their impact on effort in cost reduction. The profit function of each firm can be computed as:

$$\Pi = \frac{L}{n} - \frac{\lambda^2 L^2}{2(1+\sigma^2)n^2} - F$$

which follows a bell shape in the number of firms and is positive and decreasing for a large enough number. Under free entry we have:

$$e^e = \frac{2\lambda F}{(1+\sigma^2)\left(1+\sqrt{1-\frac{2F\lambda^2}{1+\sigma^2}}\right)} \quad \text{and} \quad n^e = \left(1+\sqrt{1-\frac{2F\lambda^2}{1+\sigma^2}}\right)\frac{L}{2F}$$

This is a case where moral hazard reduces effort and fosters entry. Moroever, the equilibrium must be fully efficient, as in the absence of investment (Bertoletti and Etro, 2024) since surplus and demand elasticities are the same. To verify this notice that the constrained-efficient allocation with marginal cost pricing solves the problem:

$$\max_{(e,n)} L \log n - L\lambda(\bar{e} - e) - n(1+\sigma^2)\frac{e^2}{2} - nF$$

The optimality conditions are respectively:

$$e = \frac{\lambda L}{(1+\sigma^2)n}$$

for effort, and

$$\frac{L}{n} = (1+\sigma^2)\frac{e^2}{2} + F$$

for the number of goods. They can be combined to show that $e^* = e^e$ and $n^* = n^e$, implying an efficient equilibrium.

2.2 A linear demand system

We can move beyond our last microfoundation by considering demand systems that depend in a general (non-multiplicative) way on the price aggregator (Spence, 1976; Bertoletti and Etro, 2024). This opens the door to competitive effects of entry and a more complex impact of moral hazard. We only exemplify this scenario by considering the following linear demand system:

$$q(p_i, A) = A - p_i \quad \text{with } A = \frac{1}{n} + \bar{p}$$

where $\bar{p}$ is the average price. This demand system can be obtained from quasi-linear quadratic preferences (see Bertoletti and Etro, 2025) represented by the following indirect utility:

$$V = \sum_{j=1}^{n} \frac{(A - p_j)^2}{2} - A$$

where the aggregator A has no impact on utility. But an analogous demand system can be also obtained from a spatial model *à la* Salop (1979) with a linear cost of distance from the ideal variety. Notice that Raith (2003) has adopted a similar spatial model, but with a quadratic cost of distance from the ideal variety, which does not allow for an explicit solution of the free entry equilibrium.

We assume always a quadratic disutility of effort for managers and a linear marginal cost with $L < 1 + \sigma^2$. The expected profits of each firm are:

$$\Pi_i = (p_i - \bar{e} + e_i)\left(\frac{1}{n} + \bar{p} - p_i\right) L - \frac{(1+\sigma^2)e_i{}^2}{2} - F$$

with first order conditions:

$$p_i = \frac{1}{2}\left(\frac{1}{n} + \bar{p} + \bar{e} - e_i\right)$$

for the price, and:

$$e_i = \frac{\left(\frac{1}{n} + \bar{p} - p_i\right) L}{1 + \sigma^2}$$

for effort. We can then solve for the symmetric equilibrium:

$$p = \bar{e} + \frac{1}{n}\left(1 - \frac{L}{1+\sigma^2}\right)$$

and

$$e = \frac{L}{(1+\sigma^2)n}$$

where clearly, an increase in the number of firms (n) reduces both effort and prices, an increase of uncertainty (σ^2) reduces effort and increases prices, and a larger market size (L) increases effort and reduces prices. The profits of each firm become:

$$\Pi = \frac{L}{n^2} - \frac{L^2}{2n^2(1+\sigma^2)} - F$$

and they are decreasing in n under our assumptions. We can now derive the free entry equilibrium:

$$e^e = \sqrt{\frac{2FL}{(1+\sigma^2)\left[2(1+\sigma^2)-L\right]}} \quad \text{and } n^e = \sqrt{\frac{L}{F}\left(1-\frac{L}{2(1+\sigma^2)}\right)}$$

In this case, as in Raith (2003), a larger market size strengthens the incentive mechanisms, because it induces a competitive effect on markups that expands sales for each firm and requires a higher investment in cost reductions. More important for our purposes, this is another example of the paradox of entry-increasing moral hazard.[6]

Finally, neither effort nor the number of firms are efficient in this example. Adopting the microfoundation of Bertoletti and Etro (2025), the constrained-efficient allocation with marginal cost pricing solves the problem:

$$\max_{(e,n)} \frac{n(A-\bar{e}+e)^2 L}{2} - AL - n(1+\sigma^2)\frac{e^2}{2} - nF$$
$$s.v. \quad : \quad A = \frac{1}{n} + \bar{e} - e$$

The optimality condition for effort is:

$$\frac{L}{n} = (1+\sigma^2)e$$

and the one for the number of goods is:

$$\frac{L}{2n^2} = F + (1+\sigma^2)\frac{e^2}{2}$$

[6] In the model of Raith (2003) moral hazard cannot increase effort, but does increase entry.

They can be solved for:

$$n^* = \sqrt{\frac{L}{2F}\left(1 - \frac{L}{1+\sigma^2}\right)} < n^e$$

with effort:

$$e^* = \sqrt{\frac{2FL}{(1+\sigma^2)\left[1+\sigma^2 - L\right]}} > e^e$$

confirming, with and without moral hazard, that the equilibrium is characterized by excessive entry and underinvestment in cost-reductions.

3 Conclusion

We have developed a model of monopolistic competition with homogeneous firms that select managerial incentives under moral hazard. Such a framework could be used to introduce informational frictions in models of trade, growth and cycles. Here we want to stress that in this competitive environment, moral hazard can exert the traditional effect of reducing effort and entry, but it can also induce paradoxical effects. The most striking is that when information on managerial effort becomes less precise and moral hazard more pervasive, firms may strengthen their incentive mechanisms and induce more effort.

References

Antón, Miguel, Florian Ederer, Mireia Giné and Martin Schmalz, 2023, Common Ownership, Competition, and Top Management Incentives, *Journal of Political Economy*, 131, 5, 1294-1355.

Bertoletti, Paolo and Federico Etro, 2024, Insufficient Entry in Monopolistic Competition, WP 543, University of Milan, Bicocca.

Bertoletti, Paolo and Federico Etro, 2025, Decomposing the Welfare Gains from Trade, *Economics Letters*, 247 (C), 112189.

Bertoletti, Paolo and Federico Etro, 2026, Monopolistic Competition with Asymmetric Information, mimeo, University of Florence.

De Pinto, Marco, Laszlo Goerke and Alberto Palermo, 2023, On the Welfare Effects of Adverse Selection in Oligopolistic Markets, *Games and Economic Behavior*, 138, 22-41.

Holmstrom, Bengt and Paul Milgrom, 1991, Multitask Principal-Agent Analyses: Incentive contracts, asset ownership, and job design, *Journal of Law, Economics & Organization*, 7, 24-52.

Serfes, Konstantinos, 2005, Risk Sharing vs. Incentives: Contract design under two-sided heterogeneity, *Economics Letters*, 88, 3, 343-3439.

Piccolo, Salvatore, 2011, A Note on Free Entry under Uncertainty: The role of asymmetric information, *Economics Letters*, 111, 3, 256-259.

Prendergast, Canice, 2002, The Tenuous Trade-off between Risk and Incentives, *Journal of Political Economy*, 110, 5, 1071-1102.

Raith, Michael, 2003, Competition, Risk, and Managerial Incentives, *American Economic Review*, 93, 4, 1425-1436.

Salop, Steven, 1979, Monopolistic Competition with Outside Goods, *Bell Journal of Economics*, 10, 1, 141-156.

Spence, Michael, 1976, Production Selection, Fixed Costs, and Monopolistic Competition, *Review of Economic Studies*, 43, 2, 217-35.