Credible Managerial Vision

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Abstract

We develop a model in which managers choose whether or not to reveal their "vision" for the future of their companies. Visionary managers are valuable because they generate incentives for workers to develop profitable innovations for the firm. However, managerial vision is not necessarily credible. After workers have invested in developing ideas, there is no a priori reason for a manager to keep her earlier promises when new contingencies arise and make it profitable to change the firm's strategic direction. We show that credible managerial vision will arise in equilibrium when managers have career concerns. In order to credibly implement their visions, managers issue public "mission statements" to motivate workers. Mission statements are not legally binding contracts and their value comes solely from their effects on managerial opportunities outside the firm. Among the new implications of the model, we show that managerial vision is more likely to be credible in industries in which managerial turnover is high and in which the managerial skill premium is high. Differently from the related literature that take managerial biases as exogenous, we show not only that biases increase workers' incentives, but also that the need to provide incentives to workers increases managers' incentives to become credible visionaries.

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1 Introduction

> Of all the things I've done, the most vital is coordinating the talents of those who work for us and pointing them towards a goal.
>
> Walter Elias Disney, Walt Disney Company Founder, 1954[1]

There is a growing literature modeling the benefits of biased managers (Rotemberg and Saloner, 1993 and 2000; Van den Steen, 2001; Hart and Holmstrom, 2002; Goel and Thakor, 2002). Managers are biased if they prefer some activities over others even when their preferred activities are not the ones that maximize firm profits. This type of bias is usually of a different nature than the ones emphasized by standard theories of moral hazard in firms. It could arise from conflicting objectives between managers and shareholders, but it may also be present even when there is no agency problem.

Economists have used many different adjectives to refer to a biased manager: visionary (Rotemberg and Saloner, 2000; Van den Steen, 2001), empathic (Rotemberg and Saloner, 1993), overconfident (Goel and Thakor, 2001), optimistic (Heaton, 1998), enthusiastic (Hart and Holmstrom, 2002). In this paper, we use the word "vision" to refer to a manager's self-reported bias.

Visionary managers may increase shareholder value. Suppose workers can spend time and effort trying to develop new ideas that, if implemented, might increase firm's profit. When effort is not contractible, workers' payoffs may depend on the implementation of their ideas by their superiors. Therefore, knowledge of their superior's vision for the future of their company is a means of providing workers with the right incentives. When managers' visions imply that they will commit themselves to always implement innovations in certain activities, workers will put more effort into developing ideas that are related to these activities. In short, vision is a partial commitment device by which managers can convince workers to exert effort in the ex ante stage (Rotemberg and Saloner, 2000; Van den Steen, 2001).

The economic literature on managerial vision usually has a behavioral interpretation for

[1] This quotation is from Schickel (1968). However, we borrowed it from Collins and Porras (1994).

managerial biases: they arise either from differences in preferences or differences in opinions.[2] Furthermore, these biases are assumed to be common knowledge. In this paper, we adopt a different approach: we assume (realistically) that managerial vision is private information. Given the positive effects of managerial vision on workers' incentives, there are incentives for managers to misrepresent themselves as having strong visions even when they do not. Because workers know that managers have incentives to lie about their vision, managerial vision is not credible in equilibrium and its benefits are rather limited. In particular, vision has no value as a commitment device.

We ask two main questions in this paper: (1) When will managerial vision be credible? (2) When will managers choose to advertise their visions (i.e. write public mission statements)? In order to answer these questions using the simplest framework we could imagine, we develop a model in which managers have no behavioral biases: everything else constant, they would like to maximize firm's value as long as they have some stake in it. However, managers may differ in their abilities in forecasting the future. This does not mean they have different opinions: all agents share the same priors ex ante, but they acquire private information as time goes on. There is an active market for executives that values good managers more than bad ones. Good managers are the ones who have more precise information about the future likelihood of success in different activities the firm may engage in. If a manager suggests a given strategic direction for the firm and later decides to change it, she signals to the market that her initial information was not very precise. Therefore, the market for executives provides managers with incentives to stick to their original plans, even when changing directions is the optimal thing to do from shareholders' standpoint. This effect makes strong visions credible, because managers will be reluctant to make changes that are not consistent with their original vision.

Career concerns make managerial vision credible, but they still cannot explain why managers will choose to make their visions public information. After all, in our model, vision is private information. A manager who decides not to reveal it does not incur in any reputational loss from

[2]We use the term "behavioral" to stress that these biases come from managers' intrinsic characteristics. We do not mean they are "irrational".

choosing to act in a way that is inconsistent with her vision. We show that managers will claim to have strong visions because they want to induce workers to exert effort. This claim is credible because workers know that managers have career concerns. Therefore, visionary managers arise endogenously in equilibrium, due to the interactions between the incentive effects of vision and managerial career concerns.

Our model shares many predictions with other papers in this literature, especially Rotemberg and Saloner (2000). Vision is more valuable in firms in which the development of new ideas is more important and in firms in which workers' effort is difficult to monitor (e.g. firms in which creativity is an important input). There are new implications as well. In particular, the career concerns element in our analysis implies that vision is more credible when managers care more about their opportunities outside the firm. Therefore, we show that visionary managers are more likely to be found in industries in which managerail turnover rates are high, because then managers are more likely to have to look for another job. For similar reasons, an increase in the managerial skill premium will increase the likelihood of finding visionary managers.

Our model also provides a rationale for the common practice of issuing "mission (or vision) statements". We show that mission statements achieve two goals: they provide information to workers and they serve as a commitment device. Public mission statements, although not legally binding contracts, are taken seriously because they expose the management's views to outsiders. When managers care about market perceptions of their underlying abilities, they will publicly expose their views only if they really intend to implement them.

Many other papers have modeled the behavior of managers in settings in which there is asymmetric information. Usually, managers will take many different sorts of inefficient actions in their attempts to conceal their private signals from the market: managers may act too conservatively or too aggressively (Zwiebel, 1995; Prendergast and Stole, 1996), they may mimic the behavior of others (Scharfstein and Stein, 1990) or they may conform to the market expectations of their choices (Brandenburger and Polak, 1996). Like these previous works, our model has an element of conformism: managers will conform to their previously stated views. Unlike them, in our model the manager uses her own conformist behavior to provide incentives to her workers.

This paper is structured as follows: Section 2 reviews some theories and anecdotes that are related to our paper. We present our benchmark model without career concerns in section 3 and show that visions are not credible. Section 4 discusses the model with career concerns and states our main results. In section 5 we make our final remarks. All proofs are in the appendix.

2 Public Announcements, Media Exposure, and Commitment: Theories and Anecdotes

In order to make a credible announcement, the party who makes the announcement must be able to convince other agents of her commitment with the announced direction. This fact has already been recognized and explored by the literature on reputation. For example, in Klein and Leffler (1981) firms will not cheat on promises to sell high quality products only if the price premium is sufficiently above publicly known salvageable production costs. Following this reasoning, Shapiro (1983) argues that this premium should compensate the firm for publicly known investments in reputation.

Closer to the ideas in this paper is the work of Hermalin (1998) on leadership. In his model, leaders must engage in costly activities to credibly signal their private information. By choosing to work hard in one specific activity, managers are able to convince workers that this activity merits full attention. Therefore, managers *lead by example.*

An important contribution of our paper to the theories of managerial leadership and credibility is that we show that public announcements can promote commitment even without involving investments in assets. This fact has already been recognized by managers themselves. We illustrate this point with an example borrowed from Collins and Porras (1994).

In 1919 Procter and Gamble decided to provide steady employment for all of its workers. The instability in the demand for labor was due to the fact that wholesalers ordered large quantities with intervals of time which could last for months, forcing P&G into a hire-and-fire routine. In 1923 a newspaper announced that P&G had achieved its goal:

> On August 1, 1923, a statement of more than usual interest to the world of labor and industry was announced by Procter and Gamble. This was a guarantee of steady employment to the employees of the company in plants and offices located in thirty cities in the United States. This epoch-making announcement meant that for the first time in American industry, the thousands of employees of one of the country's largest corporations were assured of steady employment the year round, regardless of seasonal depression in business.[3]

Why did P&G make the announcement to the "world of labor and industry" and not only to its employees? After all, there were only two parties involved in the labor contract: the firm and its workers. In the light of our paper however, one can see that the large range of this announcement could be not only important but also necessary for the achievement. When the market observes the announcement and how well the firm keep their promises, it makes its own judgement about the ability of Procter and Gamble's managers. Knowing that, managers will have a stronger incentive to pursue the goal and workers will feel more confident on the company's commitment.

As another example, on May 4th 2002 the cover matter of The Economist Magazine announced that the world was "falling out of love with celebrity chief executives". The article cites many business leaders who were worshipped during the nineties and now are helplessly watching their reputations dive. It was argued that the increasing exposure of CEOs was encouraged by the growth of new media. The creation of CNBC, Bloomberg and CNN Money, and their written media counterparts, increased demand for CEOs willing to play the role of a business hero. For those managers, it became cheaper to advertise their visions to the market.

The article suggests that the main reason for the rise of celebrity CEOs was the difficulty faced by investors to judge the quality of projects in the new economy:

> The cult of the all-powerful chief executive was fostered by the fact that investors found themselves lost in the maths of e-business. Company accounts, once a trusty

[3] This quotation is originally from Schisgall (1981).

guide, were ill-equipped to measure the strange things going on in the new economy. Investors reverted to familiar faces and seductive speeches. In the search for winners, it was easier to follow the jockey than the form.[4]

Could the e-business blur have been an important factor in the increased media exposure of CEOs? We conjecture that in such an uncertain environment the ability of the manager to choose the right direction becomes crucial and the rewards for those who seem to be good are higher.[5] Our model provides a consistent explanation for why CEOs would choose to increase their media exposure, despite the associated risks, exactly when managerial talent becomes more valuable.

3 A Model of Non-Credible Vision

"A vision without execution is an hallucination", Steve Jobs, Chairman and CEO, AOL[6]

3.1 Informal Description of the Model

Before we describe the model, we first provide an informal discussion of its main elements. We are thinking of a top manager who is responsible for the main decisions in a given firm (e.g., the CEO). The manager has some stake in the firm; therefore, she would like to choose actions that maximize firm value whenever these actions are costless to her. We abstract from issues related to the design of incentive contracts for the manager, in order to focus only on the essentials. An extension of the model in which shareholders (or the board) choose an optimal managerial compensation scheme should be straightforward.

[4] The Economist (2002), pp.11.

[5] Milbourn (2002) provides evidence of a positive correlation between stock-based compensation and CEOs' media exposure.

[6] From Garten (2002).

The type of decisions we are thinking of are broadly defined as the firm's "strategy". For example, it includes the choice of which product lines the firm will work with and which ones it will stay away from. The manager also decides whether or not to implement some innovation. Innovations (or ideas) are generated by workers who have to put some effort in order to increase the probability that a profitable idea will materialize. A crucial assumption is that workers' effort is not contractible. As in Rotemberg and Saloner (2000), we assume that workers are compensated only when they come up with new ideas *and* the manager decides to implement them.

The manager can only implement a given idea if it is related to the core of the firm's activities. For example, consider a firm that is focused in developing internet browsers. The firm is considering the possibility of becoming an internet provider as well. Their workers might try to come up with ideas about how they will price their different types of internet services to consumers. However, if the firm in the end decides not to become a provider, workers' ideas cannot be implemented.

This example illustrate a crucial feature of the model: it is important for workers' to have knowledge about the firm's future directions, because this affects the probability that their ideas will be implemented. Managers may try to convey this information: they may claim to have a *vision* for the future of the firm. For example, the CEO may tell the workers that she is committed to keep the company in the browser business and that she will never choose to become an internet provider. The problem with this promise is that it is not credible. The CEO has an incentive to claim that she has a strong vision, because if workers believe in it, they will exert more effort. However, after workers have exerted effort, she has no incentive to keep her promises and she might as well think it is a good idea to become an internet provider. In a world of rational agents, workers anticipate that managerial vision is not credible and therefore do not answer to it by exerting more effort.

3.2 The Model

There are two main strategic directions (activities) the firm can choose: C or D.[7] Strategies are mutually exclusive. There is uncertainty regarding which of the two strategies yields higher profits. We assume that C and D are equally likely to be the best strategy, from an ex ante standpoint. The revenue from adopting the good strategy is R and the revenue from adopting the bad one is zero.

There is one risk-neutral manager who derives utility only from money m. There is one expected utility maximizer worker with utility $u(m) - c(e)$, where m is money and $e \in [0, \infty)$ is effort. The concavity of $u(m)$ is not important. We assume $c' > 0, c'' > 0, c(0) = 0, \lim_{e \to 0} c'(e) = 0, \lim_{e \to \infty} c'(e) = \infty$. Without loss of generality, we also assume that $u(0) = 0$.

There are four periods.

Period 1 In period 1, the manager receives a signal $s \in \{C, D\}$. This signal equals the good strategy with probability $p > \frac{1}{2}$. This signal is private information to the manager. She can choose to costlessly communicate a message $v \in \{\emptyset, C, D\}$ to the worker. We call v her *vision*. The interpretation is that v is the activity which she claims is going to be the one chosen by the firm (either C or D). She has a choice of not disclosing her vision, in which case we say that $v = \emptyset$.

After observing v, the worker chooses an activity $i \in \{C, D\}$ for which she will try to come up with a new idea. The worker chooses to exert some effort $e \in [0, \infty)$ in the chosen activity i. We assume that the costs of effort $c(e)$ are the same in either C or D.

[7] Here we use the word "strategy" in its usual business meaning. Later we will also use the term "strategy" in its game-theoretic sense. We hope that the context will be clear enough to avoid any possible confusion between the two concepts.

Period 2 In period 2, the manager privately observes the true state of nature $a \in \{C, D\}$[8]. Immediately after observing it the manager has to make an irreversible choice of strategy $x \in \{C, D\}$. She then observes whether or not the worker managed to come up with a profitable innovation in activity $i \in \{C, D\}$. For notational purposes, we say that $S = 1$ if the idea is successful and $S = 0$ if not. The probability of a worker developing a profitable innovation is an increasing function $q(e) : [0, \infty) \to [0, 1]$, where e is the effort level chosen by the worker in period 1. We assume $q' > 0, q'' < 0, q(0) = 0, \lim_{e \to \infty} q(e) = 1$.

If $x = i$ and if i was successful, the worker's idea is implemented and the worker is paid z. Otherwise, the worker does not receive anything.

Period 3 In period 3, there is an exogenous probability θ that the relationship between the manager and the firm will be terminated. The manager's outside wage in case of termination is w. We assume that she keeps her shares in the firm α after termination.[9] This separation is not related to managerial performance. One way to interpret θ is to think of it as an exogenous probability that the manager will be offered a tempting job opportunity outside the firm and will accept it. More negatively, it can also be seen as the likelihood that the firm will shut down for reasons unrelated to managerial performance. In both cases, θ is a measure of managerial turnover intensity.

Period 4 In period 4, the true state of nature $a \in \{C, D\}$ is revealed. Firm revenue is

$$r = \begin{cases} R + h & \text{if } a = x = i \text{ and } S = 1 \\ R & \text{if } a = x = i \text{ and } S = 0 \\ R & \text{if } a = x \neq i \\ 0 & \text{if } a \neq x \end{cases} . \tag{1}$$

[8] Alternatively, we could make the more general assumption that the manager would again receive a noisy signal on the true state of the nature. This generalization however would not change the qualitative results of the paper, but would make notation more complicated.

[9] We make this assumption for notational simplicity. Nothing changes if we assume that the manager looses her shares.

The manager is entitled to a fixed fraction α of the final revenue.

3.2.1 Equilibrium

There are two players in this game: the manager and the worker.[10] There are four possible types for the manager: $(s,a) \in \{C,D\}^2$. Manager's strategies are type-dependent: $[v(s), x(s,a)] \in \{\emptyset, C, D\} \times \{C, D\}$. Notice that strategies are consistent with the timing of information revelation: v can only depend on s while x depends on both s and a. The worker chooses both i and e after observing v, therefore a strategy for the worker is denoted by $[i(v), e(v)] \in \{C,D\} \times [0,\infty)$.

Let $P(s = \delta_1 \mid v)$ denote the probability that the worker thinks that the signal received by the manager equals $\delta_1 \in \{C,D\}$ given that the worker observed v. Therefore, for each $v \in \{\emptyset, C, D\}$, we have that $P(s = C \mid v) + P(s = D \mid v) = 1$, $P(s = \delta_1 \mid v) \geq 0$ and $P(s = \delta_1 \mid v) \leq 1$ for all $\delta_1 \in \{C,D\}$. Other restrictions on these beliefs will come from the equilibrium conditions. We will use the concept of perfect Bayesian equilibrium, augmented by some refinements to rule out clearly unreasonable equilibria.

Notice that in period 1 the manager and the worker play a simple sender-receiver communication game, as in Crawford and Sobel (1982). The manager sends a (costless) message v to the worker, who then chooses an action (i,e) that will affect the payoffs of both players. As in Crawford and Sobel (1982), this simple communication game can have many equilibria. We will consider only equilibria that are not Pareto dominated by other equilibria. Because the preferences of workers and managers are aligned with respect to s (i.e., the manager wants the worker to know s), the best equilibria will display full revelation of information. These equilibria are robust to usual refinement arguments for cheap talk games, such as Farrel's (1993) "neologism-proofness" criterion, while others are clearly not. Among these, we choose the "truthful" equilibrium as the focal one; i.e., an equilibrium in which the manager truthfully reveals her information in period 1: $v(s) = s$.[11]

[10] Shareholders are passive residual claimers in our model.

[11] Other fully revealing equilibria will be equivalent to this one in the sense that they will lead to the same final payoffs for both players. For example, a strategy profile like $\{v(C) = D, v(D) = C; i(C) = D, i(D) = C\}$ is an

This is the only selection criterion we will use to refine our equilibrium concept for our benchmark model. Once we impose uniqueness in the communication stage of our model, we will show that there is only one equilibrium for the game as a whole. In what follows, whenever we claim that the equilibrium is unique, we mean an equilibrium that imposes truthful revelation of information in period 1.

A perfect Bayesian equilibrium will require sequential rationality from the manager's perspective: her choice of strategy x must be optimal given that she already knows s and a. It also implies that managerial "vision" v must be a (weakly) best response to the worker's strategy in equilibrium and to the manager's contingent plan of action $x(s,a)$ in period 2. Worker's strategy is a (weakly) best response to manager's strategy in equilibrium. Worker's beliefs must be weakly consistent with equilibrium play. For example, if $v(s) = s$ is the action chosen by the manager, then the worker should assign probability 1 to the event $s = v$ after she observes v. Given our strategy of equilibrium selection, it will not be important to impose restrictions on beliefs off the equilibrium path.

Worker behavior Here we analyze the worker's choices, taking the strategy of the manager as given. There are two main cases we want to compare. The first one is a situation in which the manager reveals her signal in period 1 (i.e., $v = s$) but she is unable to commit herself to choose $x = s$ in period 2. Therefore, since in period 2 she already knows the true state of the nature, she will always choose $x = a$. We call this case the "non-credible vision" case. The second case is the one in which the manager reveals her signal in period 1 and she is able to credibly commit herself to choose $x = a$ in period 2. We call this case the "credible vision" one.

In the "non-credible vision" case, we have $v = s$ and $x = a$. Bayesian rationality implies that worker's beliefs are such that $P[s = v \mid v] = 1$ and $P[(s,a) = (v,v) \mid v] = p$.

It is evident that, given truthful revelation $v(s) = s$, the worker's best response is such that

fully revealing equilibrium for this period 1 "game", although it strikes us as silly. For a critique of equilibria selection procedures in cheap talk games, see Farrel and Rabin (1996).

$i(v) = v$. The choice of effort $e(v)$ will be

$$e(v) \in \arg\max_{e \in [0,\infty)} pq(e)\, u(z) - c(e) \tag{2}$$

Given the assumptions above, a unique solution for this problem exists. Also, the solution is interior and therefore characterized by

$$pq'(e^n)\, u(z) = c'(e^n) \tag{3}$$

where e^n is the effort level chosen by the worker in the "non-credible vision" case. Therefore, the optimal strategy for the worker in this case must be $\{i(v) = v, e(v) = e^n\}$.

In the "credible vision" case, we have $v(s) = s$ and $x(s, a) = s$. Again, the worker chooses $i(v) = v$. The choice of effort $e(v)$ will be

$$e(v) \in \arg\max_{e \in [0,\infty)} q(e)\, u(z) - c(e) \tag{4}$$

The solution is given by

$$q'(e^c)\, u(z) = c'(e^c) \tag{5}$$

where e^c is the effort level chosen by the worker in the "credible vision" case. To save on notation, we define $q^n \equiv q(e^n)$ and $q^c \equiv q(e^c)$.

We have the following result that describes the main properties of these two cases.

Lemma 1 *Given the previous assumptions, the following results hold:*

1. *When vision is credible, workers exert more effort:* $e^c > e^n$.

2. e^n *increases with* p.

3. e^c *is invariant to* p.

The first result in Lemma 1 is one of the main ideas in this paper. It says that managerial vision, when credible, increases workers incentives to exert effort.

The second result is also very intuitive. It shows that vision has some value even if not credible: when the probability of the manager being right in period 1 p increases, workers exert

more effort. We note, however, that the effect of vision here is purely informational. The worker follows the manager's advice in period 1 because she knows that the manager is better informed. Therefore, she is willing to exert more effort when the quality of the manager's information improves (i.e, p increases).

The third result follows from the observation that, under commitment, the worker knows that her ideas will be implemented whenever they are successful (i.e., with probability $q(e^c)$). Therefore, the accuracy of manager's information (p) is irrelevant for her decision.

The First-Best As a benchmark, we consider the first-best outcome from shareholders' standpoint. We will define the first-best as the choice of $\{v(s), x(s,a)\}$ that maximizes expected profits for shareholders in the beginning of the game. Implicitly in this definition, we assume that the temporal structure of information is a constraint on the maximization problem (i.e., v can only depend on s). Also, we take z, α and the non-contractibility of e as givens.

For algebraic and interpretational simplicity, we assume that z is not a cost to shareholders. One way to interpret z is as non-pecuniary benefits that the worker receives when her idea is implemented. Nothing essential is lost with this assumption. If z represents wages that should be paid to workers by the firm, all results below are only marginally changed. We also assume that the identity of shareholders is irrelevant; therefore, in computing firm profits we do not consider managerial shareholdings α as costs.[12]

Notice that it is always optimal to reveal the manager's signal to workers in period 1, i.e. $v(s) = s$. Regardless of whether the manager can commit or not, the firm always wants the worker to choose the activity that is more likely to be profitable. Given the information available in period 1, this activity is s. The worker knows that it is in the best interest of the firm to report $v = s$ and therefore knows that the signal she is getting is the true one.

Therefore, only two strategies can be optimal for the shareholders. One is a commitment strategy, $\{v(s) = s, x(s,a) = s\}$ and the other is $\{v(s) = s, x(s,a) = a\}$.

[12]Results are exactly identical if α is considered as a cost. We choose the current approach for notational simplicity.

Let Π^c and Π^n denote firm's expected profits when vision is credible and when it is not credible, respectively. Then, we have the following result:

Proposition 1 *The difference between profits with and without commitment is*

$$\Pi^c - \Pi^n = (q^c - q^n)\, ph - (1-p)\, R. \tag{6}$$

The formula in (6) illustrates the trade-off shareholders face. Credible vision has benefits because it induces workers to exert more effort, implying that new ideas will occur more often. The first term in (6) represents the benefits from having a manager with credible vision. Notice that this term is always positive, since $q^c > q^n$. Under commitment, the gain from implementing innovations is $q^c ph$. Under no commitment, the gain from implementing innovations is $q^n ph$. Therefore, the incremental gain due to switching from no commitment to commitment is $(q^c - q^n)\, ph$.

Credible vision also has costs. Managers ignore their unambiguous information a in period 2, even when it contradicts their signal s (i.e., choosing $x \neq a$). The term $(1-p)\, R$ represents this cost. Under no commitment, the manager always makes the right choice, and his revenue (independent of innovations) is R. Under commitment, since she maintains her vision, it is pR. Since $p < 1$, this cost is positive.

Therefore, from Proposition 1 we conclude that the first-best strategy for the shareholders can be either to force the manager to announce a credible vision or to allow her to announce a vision that is not credible. When the value of ideas h increases, the value of credible managerial vision goes up. When the value of choosing the right direction R increases, the value of credible managerial vision goes down.

We have shown that there is a generically unique first-best strategy for shareholders. Now we turn to the question of whether the first-best can be implemented in equilibrium.

Equilibrium Whenever $\Pi^c - \Pi^n < 0$, the best outcome for shareholders is implemented when the manager's vision is not credible. In this case, we can show that:

Proposition 2 *If* $\Pi^c - \Pi^n < 0$*, in the (unique) equilibrium of the game, the first-best profit is achieved and managerial vision is not credible.*

This result says that shareholders can expect to get the first-best profit whenever the option to change directions in period 2 is so valuable that commitment to a strong vision is not optimal.

However, when $\Pi^c - \Pi^n > 0$, the first-best outcome cannot be implemented:

Proposition 3 *If* $\Pi^c - \Pi^n > 0$*, in the (unique) equilibrium of the game, the first-best profit is not achieved and managerial vision is not credible.*

Concluding, although the manager always claims to have a vision $v = s$ for the future of the firm, managerial vision is never credible in equilibrium, because the manager always choose $x = a$ in period 2. This implies that workers will exert less effort than what they would have exerted if managerial vision was credible ($e^n < e^c$). In the case in which shareholders would have benefited from commitment ($\Pi^c - \Pi^n > 0$), the lack of credibility of the manager's vision is a cost to shareholders.

4 Career Concerns and the Credibility of Vision

4.1 Informal Description

We consider now a situation in which managers are heterogeneous. In our model, the role of managers is to decide which activity (direction) the firm should be operating in. Therefore, better managers are the ones who are better informed.

We assume that managers have career concerns.[13] They know that there is a probability that another job opportunity might arise and that they will be inclined to accept it. They also know that any actions they take that are visible to individuals outside the firm may signal their abilities to the market. The market for executives will pay higher wages to better managers. Therefore, when choosing to announce their vision and when choosing the final direction for the

[13] The classic reference in the career concerns literature is Holmstrom (1982/1999).

firm, managers care not only about their effects on expected profits but also about the effects of their actions on the market's perceptions of their talent.

Our intuition is that, by reneging on their vision and changing strategic directions, the manager signals to the market that her signal in period 1 was not very precise. Therefore, the market thinks that a manager who does not have a strong vision (i.e., a manager who keeps changing the direction of the firm) is more likely to have low ability. Thus, some managers may stick to their vision just to pretend that they have high ability. This is how career concerns might make vision credible.

However, there is also an incentive for managers to conceal their vision from the market. If the market does not observe the manager's vision, it cannot use this information to infer anything about the manager's skills. We think this is a reasonable possibility, therefore we allow the manager in our model to choose whether to advertise her vision only internally (to her workers only) or to the outside world as well (for example, by writing "vision statements").

We show that there are some cases in which concealing her vision from the market is the best strategy for the manager. In these cases, we are back to the same equilibrium we have described in the previous section: managerial vision is never credible. The interesting case now is that there may be equilibria with credible visions as well. Workers know that when the manager makes her vision public, she has an incentive to stick to it, since otherwise she would be signaling low ability. Therefore, managerial vision, when information is public, is credible. Knowing that, managers may choose to advertise their visions to the market to induce workers to exert more effort in trying to develop profitable ideas. All this happens exactly when it is optimal (from shareholder's viewpoint) to commit to one activity only. Whenever we see a visionary manager, we know her vision is (at least partially) credible and that this credibility is increasing shareholder value.

4.2 Model

Suppose there are two types of managers: G and B. The proportion of G in the population is π. No one has private information on types, not even the manager herself. Type-G managers have

more precise first-period signals:[14]

$$p_G > p_B > \frac{1}{2}. \tag{7}$$

For notational consistency, we define the ex ante probabilities by

$$p = \pi p_G + (1 - \pi) p_B. \tag{8}$$

The model in the previous section is extended in the following way. In period 3 there is an exogenous probability θ that the relationship between the manager and the firm will be terminated. In this case, the manager will have to look for another job in a competitive market. The market places a higher value on managers of type G because they are better in choosing the right strategies. Suppose the market is willing to pay w_G for a manager of type G and w_B for a manager of type B. Without knowledge of s and a, the market pays $w = \pi w_G + (1 - \pi) w_B$.

We assume that neither s nor a can be observed by the market. On the other hand, the manager's choice x is public information. However, the manager can advertise her vision $v \in \{\emptyset, C, D\}$ in period one or choose not to reveal her vision. Two questions now arise: (1) When will visions be credible? (2) When will managers choose to advertise their visions (i.e. write public mission statements)?

We slightly modify the action space for the manager in the following way. We assume that the manager may choose to advertise her vision to the worker only or to the market as well. Formally, in period 1 she chooses both $v \in \{\emptyset, C, D\}$, which is the message she sends to the worker, and $\mu \in \{0, 1\}$, in which the convention is that $\mu = 1$ if the manager allows the market to observe (and verify) her message v and $\mu = 0$ otherwise.[15]

In period 3, if the market has not observed v (i.e., $\mu = 0$), there is not enough information to separate the types in equilibrium, because knowledge of x alone is not informative. Therefore,

[14] Managerial ability is characterized in a similar way in Scharfstein and Stein (1990) and Prendergast and Stole (1996).

[15] Although we are assuming that advertising a vision (writing a public mission statement) imposes no cost to the manager, nothing essential changes if we allow for a fixed cost c in writing statements.

the market wage for managers is the same for both types: $w(\mu = 0) = w$. On the other hand, if $\mu = 1$ the market can use its knowledge of v and x to Bayesian update its beliefs about the quality of the manager. In this case, we denote the contingent wage in equilibrium by $w(v = x)$ when the manager chooses $v = x$ and $w(v \neq x)$ when she chooses $v \neq x$.

In period 1, no extra information about types is added by the knowledge of s. In period 2, however, knowledge of a allows Bayesian updating regarding managers' types. To see this, notice that $p(s = a \mid i) = p_i$, $\forall i \in \{G, B\}$ and thus, since $p_G > p_B$, we conclude that a high-ability manager is more likely to receive the same signal in both periods than a low-ability one.

This result implies that managers are more likely to have high-ability if they receive the same signal in both periods. A Bayesian manager will think she is of type G after observing s and a with probabilities:

$$p(G \mid s = a) = \frac{\pi p_G}{\pi p_G + (1 - \pi) p_B} \tag{9}$$

and

$$p(G \mid s \neq a) = \frac{\pi(1 - p_G)}{\pi(1 - p_G) + (1 - \pi)(1 - p_B)}. \tag{10}$$

Again, since $p_G > p_B$, it follows that

Lemma 2 *Matching of signals implies that the manager is more likely to be good:* $p(G \mid s = a) > p(G \mid s \neq a)$.

If the market could observe whether $s = a$ or $s \neq a$, it would offer wages:

$$\begin{aligned} w(s = a) &\equiv p(G \mid s = a) w_G + p(B \mid s = a) w_B \\ w(s \neq a) &\equiv p(G \mid s \neq a) w_G + p(B \mid s \neq a) w_B \end{aligned}$$

Trivially, $w(s = a) > w(s \neq a)$.

We start by analyzing the equilibria of the continuation games starting at period 2.[16] Since

[16] The concept of perfect Bayesian equilibrium requires that the strategies yield a Bayesian Nash equilibrium for every "continuation game" starting in each period t, given any possible history of the game. These continuation games are not proper subgames because they do not start from a singleton information set (see Fudenberg and Tirole, 1991, chapter 8).

the only relevant private information the manager has in the beginning of period 2 is whether $s = a$ or $s \neq a$, with a slight abuse of terminology with will say that the manager is either of type $s = a$ or $s \neq a$. Her strategy can be fully described by a choice of $x = v$ or $x \neq v$.

In order to restrict beliefs off the equilibrium path, we will impose either condition D1 in Cho and Kreps (1987) or Banks and Sobel's (1987) divinity requirement. These refinements only play a role for equilibrium candidates that, we believe, are clearly not reasonable.

Our first result establishes that, in any equilibrium, managers always stick to their visions when their first-period signal s happens to be right:

Lemma 3 *In any possible equilibrium in the continuation games starting at period 2, type $s = a$ will always play $x = a$.*

When there is a separating equilibrium in the market for executives, it has to be that both types of managers choose $x = a$ and managers of type $s = a$ earn higher wages than managers of type $s \neq a$:

Lemma 4 *In any executive market separating equilibrium (i.e., whenever the market observes both $x = v$ and $x \neq v$) we have that $w_S(v = x) > w_S(v \neq x)$.*

When managers choose $x = a$, the market can observe if they are either $s = a$ or $s \neq a$, and therefore from Lemma 4 it should offer a higher wage to a manager displaying $s = a$. Therefore, if type $s = a$ deviates to $x \neq a$ she will both decrease the probability of success and receive a lower wage.

Let us consider the case in which the market observes the manager's signal s (i.e. $\mu = 1$). When the market observes $v = x$, it will offer the wage

$$w(v = x) = P(G \mid v = x) w_G + P(B \mid v = x) w_B. \tag{11}$$

When the market observes $v \neq x$, it offers

$$w(v \neq x) = P(G \mid v \neq x) w_G + P(B \mid v \neq x) w_B \tag{12}$$

where market beliefs $P(j \mid v = x)$ and $P(j \mid v \neq x)$ for $j \in \{G, B\}$ are given by

$$P(j \mid v = x) = p(j \mid s = a) \cdot p(s = a \mid v = x) + p(j \mid s \neq a) \cdot p(s \neq a \mid v = x) \tag{13}$$

and

$$P(j \mid v \neq x) = p(j \mid s = a) \cdot p(s = a \mid v \neq x) + p(j \mid s \neq a) \cdot p(s \neq a \mid v \neq x) \tag{14}$$

if for each action $v = x$ and $v \neq x$ at least one type $s = a$ or $s \neq a$ assigns a positive probability of playing it. In this case, the beliefs above are uniquely determined since $p(i \mid s, a)$ is given by (9) and (10) and $p(s, a \mid v, x)$ corresponds to the manager's strategy.

4.3 When Will Vision be Credible?

In the next proposition we show that an equilibrium in the continuation games starting in Period 2 always exists and it is unique. We also provide a full characterization of the strategy profiles and beliefs that constitute the equilibrium for each subset of parameters. Before we do that, however, we explain the results heuristically.

Notice that αR is the manager's *temptation to renege on her vision* when $s \neq a$: by choosing the right direction $x = a$, the manager gets αR with probability 1. However, a manager who observes $s \neq a$ will reveal her type by not following her stated vision and therefore will face a reduction in her expected wage in case her relationship with the firm is terminated. Therefore, a rational manager will trade-off her temptation to renege against the potential loss in pay due to revealing her type to the market. When the temptation to renege αR is sufficiently high relatively to the wage loss from type revelation, only separating equilibria will exist and vision will not be credible. On the other hand, for low levels of αR relative to the wage loss from type revelation, only pooling equilibria will exist and vision will therefore be credible.

Proposition 4 *When the manager advertises her vision ($\mu = 1$), a perfect Bayesian equilibrium for the game starting in period 2 always exists and is unique. Furthermore, the equilibrium is such that:*

1. *if* $\alpha R \in [\theta w(s=a) - \theta w(s \neq a), \infty)$*, then the only equilibrium implies full separation of types such that strategies are* $x(s=a) = x(s \neq a) = a$ *and market wages are* $w(s=a)$ *for action* $v = x$ *and* $w(s \neq a)$ *for action* $v \neq x$ *(beliefs are uniquely determined by Bayes's rule everywhere).*

2. *If* $\alpha R \in (\theta w - \theta w(s \neq a), \theta w(s=a) - \theta w(s \neq a))$ *, then the only equilibrium is a hybrid one in which type* $s = a$ *always chooses* $x = a$ *and type* $s \neq a$ *chooses* $x \neq a$ *with probability* $\beta' \in (0,1)$ *and* $x = a$ *with probability* $1 - \beta'$*, and market wages are* $w_M(v = x) = \frac{\alpha R}{\theta} + w(s \neq a)$ *for action* $v = x$ *and* $w(s \neq a)$ *for action* $v \neq x$ *(beliefs are uniquely determined by Bayes's rule everywhere).*

3. *if* $\alpha R \in (0, \theta w - \theta w(s \neq a)]$*, then the only equilibrium implies pooling of types such that strategies are* $x(s=a) = a$ *and* $x(s \neq a) \neq a$ *and market wages are* w *for action* $v = x$ *and* $w(s \neq a)$ *for action* $v \neq x$ *(off the equilibrium path, the market believes that the manager is of type* $s \neq a$ *with probability 1).*

Let β denote the probability that a manager who sees $s \neq a$ will choose to stick to her original vision $x = v$. Thus, β can be seen as a measure of *managerial vision credibility.* The proposition above implies that $\beta = 0$ in case 1 (no credibility), $\beta = \beta'$ in case 2 (partial credibility) and $\beta = 1$ in case 3 (full credibility).

Some simple characterizations of the likelihood that managerial vision, if observed, will be credible follow directly from this proposition. First, we have that

Corollary 1 *Managerial vision is more likely to be credible when the probability of separation* θ *is high.*

An increase in θ will increase both intervals in cases 2 and 3, implying that there would be more parameter values in which vision is at least partially credible. Intuitively, vision is more credible when the manager cares more about his reputation outside the firm.

For the same reasons, vision will also be more credible when managerial talent is more important. To see this, consider a mean-preserving spread in the wage distribution, i.e. let w_G go up and

w_B go down in a manner that keeps w constant. The wage gap in period 2 $w(s=a)-w(s\neq a)$ will go up, implying that the intervals in cases 2 and 3 will both increase. Again, in such case there would be more parameter values in which vision is at least partially credible.

Corollary 2 *Managerial vision is more likely to be credible when the managerial skill premium $w_G - w_B$ is high.*

4.4 When Will Visionaries Arise?

The uniqueness of the solution of the game in period 2 guarantees that β is always unique. Fully rational players will correctly anticipate β when making their first-period decisions. Therefore, when facing a credibility degree of β, workers will choose their effort in order to

$$\max_{e\in[0,\infty)} [p+(1-p)\beta]\, q(e)\, u(z) - c(e). \tag{15}$$

Given the assumptions above, a unique solution for this problem exists. Also, the solution is interior and therefore characterized by

$$[p+(1-p)\beta]\, q'(e^*)\, u(z) = c'(e^*). \tag{16}$$

We define $e(\beta) : [0,1] \to [0,\infty)$ as the solution of the problem above as a function of each possible β. Clearly, $e(\beta)$ is strictly increasing in β. We define $q(\beta) \equiv q(e(\beta))$. Then, $q(\beta)$ is also strictly increasing in β. It is also easy to see that $q(\beta) \in [q^n, q^c]$.

Expected profits in period 1 can be written as

$$\Pi(\beta) = [1-(1-p)\beta]\, R + q(\beta)\, ph. \tag{17}$$

We define the set

$$A \equiv \{\beta \in [0,1] \mid \Pi(\beta) > \Pi^n\}.$$

The next proposition completes the full characterization of the solution of this model. We make the harmless assumption that when the manager is indifferent between advertising his vision or not, she will choose $\mu = 0$.

Proposition 5 *Let β be degree of commitment, which is uniquely determined by the parameters of the model. The manager will choose to advertise her vision ($\mu = 1$) to the market if and only if $\beta \in A$.*

Now we already have fully described the equilibrium play. For any given set of parameters, proposition 4 fully characterizes the unique equilibrium of the continuation game starting in period 2. It also determines a unique β. Workers then can compute their desired level of effort $e(\beta)$ conditional on observing $\mu = 1$. If they observe $\mu = 0$, they rationally choose e^n. With knowledge of $e(\beta)$ and e^n, the manager can construct the set A. If $\beta \in A$, the manager chooses $\mu = 1$ and if $\beta \notin A$, she chooses $\mu = 0$.

Welfare analysis (using shareholder value as the metric) implies that, whenever managers care for their opportunities outside the firm, shareholders are never worse off. It is clear that the manager will only choose to advertise their visions whenever it increases firm value, as compared to the default non-credible profits Π^n.

We can now formally establish our claim that managers' incentives to behave as credible visionaries (i.e., to choose $\mu = 1$) are higher the higher is the benefit h from worker's effort. It follows directly from our characterization of the equilibrium that:

Corollary 3 *Managers are more likely to behave as visionaries in firms in which the output from development of new ideas (h) is higher.*

5 Final Remarks

The equilibria described above have many important and intuitive features. In this model advertisement is not motivated by the will of a good manager to separate herself from a bad one. The decision of whether or not to advertise her vision is taken before a manager has any information to update her beliefs about her own ability. In fact, while there are equilibria in which a manager's vision is advertised, there are no fully separating equilibria. Here what makes a manager willing to advertise her vision is the benefits from motivating her workers, more specifically,

making them invest in the announced strategic direction. Moreover, what makes them confident to invest is their belief that even if the manager later realizes that the original direction was not the best, she will stick to it due to her career concerns.

Second, the equilibrium changes according to the value of the options available to the manager who is most uncertain about the right direction to be taken (the $s \neq a$ type). For a manager who chooses to advertise her vision, if the benefits of choosing the direction which seems most appropriate in the end are too high, she would never advertise her vision in the first place. This corresponds to the interval in item 1. For the interval described in item 3, sticking to the advertised vision is optimal under any circumstances. In its unique equilibrium the manager advertises her vision, does not deviate from it and workers choose an effort level that is compatible with with their beliefs.

Concluding, managerial career concerns play a crucial role exactly when it is optimal (from shareholders' perspective) to commit to a specific vision. Provided that the cost of writing a public vision statement is small, the manager will find it optimal to advertise her vision to the market and, therefore, her stated vision to workers is credible.

A Appendix: Proofs

Lemma 1

Proof. Define the function $e(y)$ implicitly by

$$yq'(e)\,u(z) - c'(e) = 0. \tag{18}$$

By the implicit function theorem, we have

$$\frac{de}{dy} = -\frac{q'(e)\,u(z)}{yq''(e)\,u(z) - c''(e)}. \tag{19}$$

For any positive y, we have that $\frac{de}{dy} > 0$, since our assumptions guarantee that $q'(e)\,u(z) > 0$ and $q'' < 0$ and $c'' > 0$.

Letting $y^n = p$ and $y^c = 1$, and since $p < 1$, it follows then that $e^c > e^n$, proving (1).

We also have that

$$\frac{dy^n}{dp} = 1 \tag{20}$$

proving (2). The result in (3) follows directly from the fact that p does not enter in the first order condition for the "credible-vision" case. ■

Proposition 1

Proof. Profit under no commitment is

$$\Pi^n = q\left(e^n\right) p\left(R + h\right) + \left\{\left[1 - q\left(e^n\right)\right] p + 1 - p\right\} R. \tag{21}$$

Simplifying it, we get

$$\Pi^n = R + q^n ph. \tag{22}$$

In contrast, expected profit under commitment is

$$\Pi^c = q\left(e^c\right) p\left(R + h\right) + \left[1 - q\left(e^c\right)\right] pR. \tag{23}$$

Simplifying it, we get:

$$\Pi^c = pR + q^c ph. \tag{24}$$

The difference between the two is given by

$$\Pi^c - \Pi^n = \left(q^c - q^n\right) ph - \left(1 - p\right) R. \tag{25}$$

■

Proposition 2

Proof. We first show that strategies $\left\{v\left(s\right) = s, x\left(s, a\right) = a\right\}$ for the manager and

$\left\{i\left(v\right) = v, e = e^n\right\}$ for the worker constitute a perfect Bayesian equilibrium of the game played by these two agents.

We start by showing that $x\left(s, a\right) = a$ is a strictly dominant strategy in period 2 if the manager follows $v\left(s\right) = s$ in period 1 and as long as we restrict the worker's strategy to the set $\left\{i\left(v\right) = v, e \in \left[0, \infty\right)\right\}$.

In period 2, the manager learns a. Say that $s = a$. Therefore, choosing $x = a$ gives her utility of

$$U(x = a \mid s = a) = \alpha [q(e)h + R]. \tag{26}$$

Choosing $x \neq s$ gives her

$$U(x \neq a \mid s = a) = 0. \tag{27}$$

Clearly, (26) is positive, and then $U(x = a \mid s = a) > U(x \neq a \mid s = a)$.

Suppose now that $s \neq a$. Therefore, choosing $x = a$ gives her utility of

$$U(x = a \mid s \neq a) = \alpha R. \tag{28}$$

Choosing $x \neq s_2$ again gives her

$$U(x \neq a \mid s \neq a) = 0. \tag{29}$$

Analogously, and it follows that $U(x = a \mid s \neq a) > U(x \neq a \mid s \neq a)$. Therefore, choosing $x = a$ is a dominant strategy in period 2.

Going back one period, given that the worker chooses $i = v$ and that manager wants to maximize the likelihood of getting h, it is optimal for her to report $v(s) = s$. From the worker's standpoint, given that the manager chooses $v = s$, the best predictor of a is s. Therefore, the worker chooses $i = v$.

The worker's choice of effort will be given by:

$$pq'(e^n) u(z) = c'(e^n). \tag{30}$$

Therefore, $\{v(s) = s, x(s, a) = a; i(v) = v, e = e^n\}$ is an equilibrium. Given that $\Pi^c - \Pi^n < 0$, this equilibrium implements the first-best outcome for shareholders.

This equilibrium is also unique, at least in the following sense. $x = a$ is a strictly dominant strategy in period 2. The choice of e^n is also unique given that $x = a$ and $v = s$. The only possibility of non-uniqueness is in the message game between the manager and the worker. While this message may have other equilibria (i.e., an uninformative equilibrium in which the manager chooses a random signal v and the worker chooses to ignore the signal), reasonable equilibrium

refinements should let us only with $v = s$ and $i = v$. This is the only equilibrium in which the manager truthfully reveals her information in the message game in period 1. ■

Proposition 3

Proof. As in the case of Proposition 2, the strategy profile that assigns strategies

$\{v(s) = s, x(s, a) = a\}$ for the manager and $\{i(v) = v, e = e^n\}$ for the worker is the unique equilibrium. Since the proof of Proposition 2 does not depend on the sign of $\Pi^c - \Pi^n$, it also applies here. But shareholders' profit in this case is Π^n, while the first-best profit is Π^c. ■

Lemma 2

Proof. In text. ■

Lemma 3

Proof. Suppose we are in a pooling equilibrium in which both types play $x \neq v$. The equilibrium wage on the equilibrium path should be w, and $w_P(x = v)$ should be strictly less than w for this to be an equilibrium, otherwise type $s = a$ would surely want to deviate. This implies that the market beliefs should be such that, in case it observes a deviation, it attributes a probability higher than $(1 - \pi)$ that type $s \neq a$ was the one deviating from equilibrium play. However, for all beliefs and equilibrium best response actions chosen by the market that would make type $s \neq a$ willing to deviate, type $s = a$ would also want to deviate. Therefore, the divinity criterion of Banks and Sobel (1987) requires that the market's belief that the type $s \neq a$ was the one deviating to be no greater than $1 - \pi$. But with this restriction on beliefs eliminates all pooling equilibria in which $w_P(x = v) < w$, therefore there is no equilibrium in which both types play $x \neq v$.

In a fully separating equilibrium, if $s = a$ chooses $v \neq x$, $s \neq a$ will also want to choose $v \neq x$, but then this will not be a separating equilibrium. In a hybrid equilibrium, type $s = a$ will only randomize between $x \neq v$ and $x = v$ if she is indifferent between the two. This implies $w_H(x = v) < w_H(x \neq v)$. But then type $s \neq a$ will always choose $x \neq v$, thus Bayesian updating implies $w_H(x = v) > w_H(x \neq v)$, which is a contradiction. ■

Lemma 4

Proof. Suppose $w(v = x) \leq w(v \neq x)$. If $s = a$ chooses $v = x$ and $s \neq a$ chooses $v \neq x$,

this cannot be an equilibrium because from Lemma 2 the market should offer a higher wage to a manager for whom $s = a$. If $s = a$ chooses $v \neq x$, $s \neq a$ will also want to choose $v \neq x$, but then this will not be a separating equilibrium. ■

Proposition 4

Proof. We will first establish some results and define some notation.

Let us suppose that a separating equilibrium exists. Lemma 3 implies that types $s = a$ and $s \neq a$ must assign probability one to $v = x$ and $v \neq x$, respectively. Therefore, market beliefs obey (13) and (14), and then (11) and (12) specialize to:

$$w_S(v = x) = w(s = a) \equiv p(G \mid s = a) w_G + p(B \mid s = a) w_B \tag{31}$$

and

$$w_S(v \neq x) = w(s \neq a) \equiv p(G \mid s \neq a) w_G + p(B \mid s \neq a) w_B.$$

Therefore, beliefs are uniquely defined in a separation equilibrium. From Lemma 4, it follows that

$$w_S(v = x) > w_S(v \neq x). \tag{32}$$

Suppose that in period 2 we have $s \neq a$. If the manager chooses $x = a$, we define expected profit in period 2 as

$$V_S(v \neq x \mid s \neq a) = \alpha R + \theta w(s \neq a). \tag{33}$$

However, if she chooses $x = s$, her expected utility is

$$V_S(v = x \mid s \neq a) = \theta w(s = a). \tag{34}$$

Therefore, the following Lemma is straightforward:

Lemma 5 *A necessary and sufficient condition for a separation equilibrium to exist is that*

$$\alpha R \geq \theta [w(s = a) - w(s \neq a)].$$

The sufficiency of this condition for the existence of a separating equilibrium follows immediately from the fact that whenever type $s \neq a$ does not have incentives to deviate from a separating equilibrium, type $s = a$ has even fewer incentives to deviate. The separating equilibrium is unique among the class of separating equilibria due to Lemma 3.

Suppose now we are in a pooling equilibrium. Lemma 3 implies that both types choose $v = x$, implying that market beliefs obey (13) only. (11) specializes to

$$w_P(x = v) = \pi w_G + (1 - \pi) w_B = w.$$

In a pooling equilibrium, if the manager chooses $x = a$, her expected utility in period 2 is

$$V_P(v \neq x \mid s \neq a) = \alpha R + \theta w_P(v \neq x). \tag{35}$$

However, if she chooses $x = s$, it is

$$V_P(v = x \mid s \neq a) = \theta w. \tag{36}$$

Cho and Kreps (1987) D1 criterion implies that the market should think that type $s \neq a$ is infinitely more likely to deviate than $s = a$ in a pooling equilibrium, implying that

$$w_P(v \neq x) = w(s \neq a)$$

Therefore, the following Lemma is straightforward:

Lemma 6 *A necessary and sufficient condition for a pooling equilibrium to exist is that*

$$\alpha R \leq \theta [w - w(s \neq a)].$$

The sufficiency of this condition for the existence of a pooling equilibrium again follows from the fact that whenever type $s \neq a$ does not have incentives to deviate from a pooling equilibrium, type $s = a$ has even fewer incentives to deviate. The pooling equilibrium is unique among the class of separating equilibria due to Lemma 3 and to the fact that imposing Cho and Kreps's D1 refinement completely pins down beliefs off the equilibrium path.

Consider now the possibility of a hybrid equilibrium. Lemma 3 implies that only those managers who observe $s \neq a$ may randomize. Since the $s \neq a$ type (and only this type) chooses $x \neq v$ with positive probability, it follows that the wage in this case should be the same as in a separating equilibrium, that is, $w_M(x \neq v) = w_S(x \neq v)$. If the manager chooses $x = a$, her expected utility in period 2 is

$$V_M(v \neq x \mid s \neq a) = \alpha R + \theta w(s \neq a). \tag{37}$$

However, if she chooses $x = s$, it is

$$V_M(v = x \mid s \neq a) = \theta w_M(v = x). \tag{38}$$

Given that the manager should be indifferent between the two, we have that

$$w_M(v = x) = \frac{\alpha R}{\theta} + w(s \neq a).$$

Let β' be the proportion of type $s \neq a$ who chooses $v = x$. In game-theoretic jargon, β' is the action prescribed by her *behavior strategy* when she learns that her type is $s \neq a$. Since $\beta' < 1$ (otherwise we are in a pooling equilibrium), we require that

$$w_M(v = x) > w$$

which implies

$$\frac{\alpha R}{\theta} + w(s \neq a) > w.$$

Note also that Bayesian updating implies that

$$\begin{aligned} w_M(v = x) &= \beta' w(s \neq a) + (1 - \beta') w(s = a) \\ \beta' &= 1 - \frac{\frac{\alpha R}{\theta}}{w(s = a) - w(s \neq a)}. \end{aligned}$$

Because $0 < \beta' < 1$ in a hybrid equilibrium, the following Lemma is straightforward:

Lemma 7 *A necessary and sufficient condition for a hybrid equilibrium to exist is that*

$$\alpha R > \theta [w - w(s \neq a)]$$

and

$$\alpha R < \theta \left[w_S \left(x = v \right) - w_S \left(v \neq x \right) \right].$$

Again, this hybrid equilibrium is unique among the class of hybrid equilibria.

We note that the three intervals for αR described by the Lemmas above are disjoint, therefore there is no case in which two different types of equilibrium exist. Since equilibrium is unique in each interval, there is at most one equilibrium for the game. Because the union of the three intervals is equal to $(0, \infty)$, then an equilibrium always exists. ■

Proposition 5

Proof. The crucial part of the proof is to recognize that, no matter what β is, the manager in period 1 never expects to increase her wage by choosing $\mu = 1$.

To see this, notice that the expected wage in a pooling equilibrium is w, while the expected wage in a separating equilibrium is

$$pw_S \left(x = v \right) + \left(1 - p \right) w_S \left(v \neq x \right) =$$

$$p \left[p \left(G \mid s = a \right) w_G + p \left(B \mid s = a \right) w_B \right] + \left(1 - p \right) \left[p \left(G \mid s \neq a \right) w_G + p \left(B \mid s \neq a \right) w_B \right] =$$

$$p \left[\frac{\pi p_G}{p} w_G + \frac{\left(1 - \pi \right) p_B}{p} w_B \right] + \left(1 - p \right) \left[\frac{\pi \left(1 - p_G \right)}{1 - p} w_G + \frac{\left(1 - \pi \right) \left(1 - p_B \right)}{1 - p} w_B \right] =$$

$$\pi w_G + \left(1 - \pi \right) w_B = w.$$

Similar algebra can be shown to imply that the expected wage in a hybrid equilibrium is also w.

Therefore, the choice between $\mu = 1$ and $\mu = 0$ can only affect profits. For a given β, the manager expected payoff from choosing $\mu = 0$ is

$$\alpha \left(R + q^n ph \right) + \theta w = \alpha \Pi^n + \theta w$$

while her expected payoff from choosing $\mu = 1$ is

$$\alpha \left\{ \left[1 - \left(1 - p \right) \beta \right] R + q \left(\beta \right) ph \right\} + \theta w = \alpha \Pi \left(\beta \right) + \theta w.$$

Therefore, a necessary and sufficient condition for the manager to choose $\mu = 1$ (recall that ties are broken in favor of $\mu = 0$) is that $\Pi \left(\beta \right) > \Pi^n$, or equivalently, $\beta \in A$. ■

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