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Abstract

We develop a reputational cheap talk model where the principal can cancel an action initially started on the advice of an expert if she gets an unfavorable interim news. But if the *status quo* is reinstated, the principal is unable to verify the true state of the world. In the model, experts want to appear smart and we find that the possibility of canceling the action encourages less well informed experts to recommend it more often. We then show that gaining access to an interim news as well as improving the quality of an existing one can both reduce the principal's welfare. The model implies that delegating the decision rights to another person with different preferences can be used as a commitment device by the principal and might improve her welfare.

Key words: career concerns, reputational cheap-talk, signaling game

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JEL-Classification: D82, D83

1. Introduction

People often seek expert advice when making important decisions. It is also common that after the initial decision, there is a period of time in which people can revise and change their course of action. Within this period, a second opinion or interim information that can probabilistically indicate if the initial decision was right is generally considered useful. For example, governments often choose to "phase-in" important reforms so that

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they have the option to scrap the project if the interim feedback is sufficiently negative. This paper asks whether such "second opinion" is indeed necessarily valuable for the principal.

We will use a stylized example to illustrate the model, although the findings are generalizable to other contexts. Consider a government/principal (she) who first seeks expert advice to decide between implementing a reform and maintaining the *status quo*. The expert's (he) information, however, may be noisy. In addition, the expert wants to appear capable due to concerns like earning higher future wage or enhancing his social status etc. Because of these career concerns, he may have an incentive to distort his recommendation. Although the principal might start the reform after consulting the expert, she could have lingering doubts about its appropriateness. If she can access an interim news (possibly imperfect) about the merits of the reform from some other sources, she can revert back to the *status quo* if the news is unfavorable. Generally such interim news is available to a government from the media, opinion polls, feedback from political parties and constituencies or from the government's own research/information institutions. We will first study the effect of the interim news on the expert's recommendation strategy and then investigate its overall effect on the principal's welfare.

An important feature of the environment modeled here is that if the *status quo* is chosen, the principal does not get to know the true state of the world– i.e. whether it is appropriate for the action/ reform. The choice of the reform alone can produce deterministic knowledge of the true state. This also means that the principal cannot accurately evaluate the expert if she chooses the *status quo*. For example, a government is unable to learn if oil reserve exists at a certain site without pilot drilling, or if a reported address is indeed a hide-out for terrorists without raiding it. In both examples the advice of the expert or informer would remain untested without the corresponding action. Several studies (see below) have shown that if the *status quo* is less informative than the action, then the less informed experts tend to recommend the *status quo* more often. We extend the scope of the models of this genre by exploring the effect of an interim news available sometime between the initiation of the reform and its eventual outcome. While this opens up potential benefit for the principal, it also leads to change of recommendation strategy by experts in the first place. A less informed expert would want to take advantage of the fact that if the principal goes back to the *status quo*, she would have less information when evaluating his quality. One of our results shows that in situations where the principal's equilibrium behavior is to discontinue the reform when the interim news is unfavorable, less informed experts would recommend the reform more often at the initial consultation stage.

Given that the expert's strategy is affected, the overall effect of the interim news on the principal's payoff can be ambiguous. In the central result (Proposition 4) of the paper, we claim that interim news that is not very precise can hurt the principal when the information of less informed experts is also of poor quality. In this situation, the principal would be better off if she can credibly commit not to receive any interim news at all. In a related inquiry, we take the existence of the interim news as given and assume that it is sufficiently good so that the principal would act according to it. We then ask if her payoff would necessarily increase with the precision of that news. We show that the answer is ambiguous as it depends on the quality of information of the less informed among the expert community. Better interim news reduces these experts' incentive to make pro-reform recommendations; but this is not always a blessing for the principal. It may go against the principal's interest if the less informed experts' information is not too noisy. Hence there are instances where the principal would be worse off with more precise (even perfect) interim news.

These questions are relevant only if it is within the principal's control to avail or not avail an interim news, and if it can control the quality of that news. As example, when a government decides whether to set up an independent monitoring committee to monitor the progress of the reform, it decides between having and not having an interim news. At this stage it can also control the quality of the potential feedback from this source of news. In many other situations, however, the existence and the quality of the interim news is outside her control, e.g. when it arises in the open through the media and the political process. We will show that in these scenarios, the principal can improve her welfare by delegating the decision rights to another decision-maker whose preference is "publicly" known to be different from hers. Typical delegates in these cases are persons known as significantly pro-reform or against it as the case may be. This signals a pre-commitment to a particular course of action following the interim news and thus affects the strategy of the less informed experts. Officials selected in charge of a reform sometimes appear surprisingly rigid or dogmatic when persisting with it in the face of what publicly appears as unfavorable news. In some other cases, the officials might be seen to be too fickle, swaying with the wind as it were and abandoning a reform mid-way. Our model suggests that in some of these cases the principal effectively pre-commits to a particular reaction to the interim news and thus is able to avoid (resp. exploit) its detrimental (resp. beneficial) strategic effect.

The paper is organized as follows. We will discuss the relevant literature in the rest of this section. In section 2 we set out the assumptions and structure of the main model and develop the necessary notations. Section 3 contains the characterization of equilibria. Section 4 investigates the central welfare questions of the paper. There we first analyze whether gaining access to the interim news improves the principal's welfare and then the effect of improved precision of the interim news. We then analyze the possibility of delegation. Section 5 discusses the role of the characteristic assumptions of the model, and some other modeling choices. Here we also discuss the robustness of the paper's conclusions with respect to these choices. Section 6 concludes the paper by summing up its contributions. All proofs are in the Appendix.

Related Literature

Our paper shares a number of assumptions and questions with the literature on career concerns. Following the work of Scharfstein and Stein (1990), a number of papers modeled career concerns by assuming that experts try to convince people that they have accurate information by using (possibly) distorted reports.[2] Career concerns take this form in our paper, too[3]. Secondly, our assumption that the choice of *status quo* shuts

[2]Ottaviani and Sorensen (2006a and 2006b) investigate the expert's (mis-)reporting incentives in very generalized settings. Visser and Swank (2007) and Levy (2007) have multiple-expert models and investigate their behavior as well as the welfare implication of different voting rules. In Effinger and Polborn (2001) experts deliberately choose to disagree with their colleagues in order to fool the market into believing that they are possibly smarter than others.

[3]Assuming that the expert wants to appear well informed is not the only way that career concern has been modeled. Holmstrom (1999) assumes that the agent wants to impress people with his level of productivity. Some works assume that the expert wants to establish a reputation of being "good" or

out the possibility of learning is a crucial assumption in several earlier works. Suurmond *et al* (2004), Song and Thakor (2006), and Fu and Li (2010) use it to show, among other things, that less informed experts have a bias towards the choice of the *status quo*. Experts in our paper know their own types and that is private information. Levy (2004 and 2005) models experts with similar private information. Due to signalling incentives, experts with low information quality in Levy's models are shown to excessively contradict the 'conventional wisdom'. Prat's (2005) paper asks, like us but in a different model, whether having more information is beneficial to the principal. It finds that being able to observe the actual action taken by the expert instead of just its consequences can harm the principal because the expert has an incentive to conform to actions that appear smarter.

While these are the overlapping features, our paper departs from the literature as the inquiry takes us to a combination of features, which, to the best of our knowledge, has been scarcely explored. First, we have a two-stage model. The expert's recommendation strategy in the first stage and the principal's reaction to the interim news in the second are mutually dependent. Since the state remains unobserved if the principal goes back to the *status quo*, her choice after the interim news has serious effect on the expert's reporting incentive and this is one of the elements driving our results. Second, in our model, the expert who has reputational concerns is separate from the decision-maker who makes the project choices. The effects of the two stage structure on behavior would be mostly lost if the expert also happened to be the decision-maker. For example, a paper by Majumdar and Mukand (2004) has a multi-stage model like ours but the decision-maker and the expert are not two separate actors. One of the main problems investigated in their model is the persistence of inefficient policies, whereas in our paper the principal can be harmed by the interim news if she *cannot* commit to persisting with the reform to the end.

Two very recent studies share some similar features with our paper. Liu (2011) investigates a symmetric information setting where the principal might receive information from several sources simultaneously and can communicate with the expert about this in-

"honest", eg. Sobel (1985) and Morris (2001).

formation. A crucial difference between that paper and ours is that in our case the expert is able to completely block the principal's learning if he can convince her not to initiate the reform in the first period. We will defer further discussion of simultaneous reporting and symmetric information to sections 5.2 and 5.3. Felgenhauer and Schulte (2011)[4] has a model that partly resembles the first stage in our model setting. The principal in their model gets preliminary information about a potential project. She then pre-selects whether to pass it to the expert who would advise for or against its implementation. Since the outcome of the pre-selection changes the expert's belief about the project, the focus of the study is how social welfare is affected by the quality of pre-selection. Our study can be seen as complementary in a sense as our focus is exactly the opposite: we study the welfare effect of the second opinion that comes *after* the initiation of the project[5].

2. The Model

2.1. Timing and Payoffs

The principal/government considers an action/reform. In state of the world $\omega = 1$, the reform would succeed and the principal would get the return $Y_R = 1$. In state $\omega = 0$, the reform fails and the return is $Y_R = -c$ ($c > 0$). Alternatively, the principal may maintain the *status quo*, in which the return is independent of the states and is normalized to $Y_S = 0$. In the main model, we assume that the common prior is that both states are equally likely. The principal takes advice from an expert, who gets a private signal $s \in \{0, 1\}$. The expert is either better informed ($i = H$) or less informed ($i = L$). An H-type expert gets perfect information about the state so that $Pr(s = \omega|H) = 1$. An L-type expert's information is noisy and $1 > Pr(s = \omega|L) = p > \frac{1}{2}$. An expert alone knows his type; but it is common knowledge that a proportion $r \in (0, 1)$ of all experts are of H-type.

[4]We are grateful to the referee who directed us to this paper.

[5]Ottaviani and Sorensen (2001) and Li (2007) also have multiple rounds of communication. However, in their settings, the first signal is always transmitted truthfully, and they are interested in how subsequent messages are distorted. Again, we do exactly the opposite. We assume the interim news is truthfully transmitted but focus on its effect on the first message sent by the expert.

The game extends over two periods, $T = 1, 2$. At $T = 1$, the principal first consults the expert. The expert gives her a message from $m \in \{0, 1\}$. Let $t_i : \{0, 1\} \to [0, 1]$ denote the i -type expert's strategy, which is the probability that he reports $m = 1$ when his signal is s. For expositional convenience, we will use t_{is} to denote this probability when the i-type expert gets signal s.[6] Upon receiving the expert's message, the principal decides whether to initiate the reform. Let α_m denote the principal's posterior belief that $\omega = 1$ after the message m. If she keeps to the *status quo*, no more action or information is available and the game ends with the return $Y_S = 0$. On the other hand, if she starts the reform, she has to pay a non-refundable initiation cost $k \in (0, 1)$. It takes a while for the outcome of the reform to be realized. Conditional on the initiation of the reform, the principal will receive an interim news $n \in \{g, b\}$ about the prospect of the reform at $T = 2$. If the state is $\omega = 0$ (so that the reform will fail), the interim news is always b (bad), so that $Pr(n = g|\omega = 0) = 0$. On the other hand, if $\omega = 1$, the interim news will be g (good) with probability $\beta \in [0, 1]$, i.e., $Pr(n = g|\omega = 1) = \beta$.[7] On getting the interim news, the principal can choose to persist with the reform or revert back to the *status quo*. If she persists with the reform, her return depends on the true state of the world. If she reverts back to the *status quo*, she gets $Y_S = 0$. We summarize the timing here:

1. At $T = 1$, the expert sees a signal s and his own type. He sends a message m to the principal.
2. The principal chooses between the *status quo* and the reform. If the reform is chosen, she pays a non-refundable initiation cost k. The game ends if the *status quo* is chosen.

[6] We could instead assume a richer message space like in Ottaviani and Sorensen (2006a and 2006b). However, even in the more generalized setting, we can still model the expert's strategy as a distribution over messages given his signal. Therefore, the principal can rationally update her belief about the expert's true signal just like in our model. Second, we can also allow the expert to directly report his type. This is investigated in Levy (2004) who shows that the expert can never credibly transmit such information. Therefore, our main results will not be affected if we allow for richer message spaces.

[7] We assume this asymmetric structure because the calculation is easier. Results do not change qualitatively if we assume that errors in the interim news are symmetric.

3. If the reform is started the principal receives an interim news of precision β at $T = 2$ and decides whether to continue with the reform.
4. The principal finds out the true state if and only if she has persisted with the reform after the interim news. The players receive their payoffs (see below).

We assume that the principal cares only about the return from the reform, which is given by

$$W = \begin{cases} 0 & \text{if the reform is not initiated at } T = 1. \\ Y_R - k & \text{if the reform is carried out to the end.} \\ -k & \text{if the reform is started at } T = 1, \text{but canceled at } T = 2. \end{cases}$$

The expert cares only about his reputation $\hat{r}$, defined as the posterior probability at the end of the game that the principal thinks he is of H-type. It is derived via the Bayes' rule from all the information the principal has at the end of the game including the message sent by the expert, the observed output and the interim news received (if the reform is initiated at $T = 1$). This is a common measure of reputation in the career concern literature where it is assumed that the expert's future wage is positively correlated with $\hat{r}$. For the sake of simplicity, we follow the majority of the literature in assuming that the expert's payoff is linear in his reputation. The payoff is thus taken as $\hat{r}$ itself.

2.2. Equilibrium selection

We look for (weak) Perfect Bayesian Equilibria (PBE) of the game. It is known that reputational cheap talk games can have a wide range of PBE. For example, there are always babbling equilibria where both types of experts send massages at random which are taken as meaningless by the principal. However our interest centers on the welfare gain (or loss) of the principal due to her engagement with experts and the interim news. So we are interested in equilibria where the expert's recommendation is useful to her. The equilibria we focus on satisfy the following two conditions listed in this subsection:

Condition 1. *Some of the principal's choices must depend on the message sent by the expert.*

We will call those equilibria that satisfy condition 1 "Influential Equilibria". This is a natural requirement given the inquiry of the paper: if the expert's recommendation never influences the principal's choice, it cannot be of any use for her and her welfare is the same as if she acted alone.[8]

We impose a second requirement for the equilibria of interest. There are influential equilibria where the principal never changes her assessment of the expert at the end of the game. As example, consider the strategies: an L-type expert always truthfully reports his signals; an H-type expert reports his signals truthfully with probability p. Therefore, the message sent by the expert, whatever his type, is correct with probability p. When p is sufficiently large, Condition 1 is met because the principal's initial choice will follow the expert's recommendation. However, both type of experts are equally likely to make a wrong recommendation in equilibrium. So the principal's posterior assessment of the expert's quality is always the same as the prior regardless of whether she can observe the true state. Therefore no expert has an incentive to deviate. We will leave out this type of equilibria for two reasons. First, these equilibria are not robust. If experts have even an arbitrarily small concern for the principal's welfare, then an H-type expert would strictly prefer to deviate and tell the truth. Second, since the principal's *ex post* assessment of the expert never changes no matter if his message is correct or not, it follows that the interim news cannot have any effect on the expert's reporting strategy. (See section 3.2 and the proof of Proposition 2.) Therefore this class of equilibria would distract us from our main interest, namely, the effect of the interim news. Hence we add the second restriction.

Condition 2. *There is a positive probability that the principal's posterior assessment of the expert* $\hat{r} \neq r$ *at the end of the game.*

[8]Our notion of influential equilibrium requires a stronger condition than the commonly used informative equilibrium, which requires that the expert's messages change the principal's belief regarding the state. The latter condition is necessary, but not sufficient for an influential equilibrium. For example, when the cost c and k are very small and the interim news does not exist, there is an informative equilibrium where the principal *always* carries out the reform, and the expert tells the truth (see the next subsection). Obviously the principal's belief on the state depends on the expert's messages but she never uses them for her choice.

It is commonly assumed in communication games that players know the exact meaning of the messages. Hence we will ignore mirror equilibria that just re-label the messages. This means that in any influential equilibrium, the principal's belief on the state is such that $\alpha_1 > \frac{1}{2} > \alpha_0$. We also restrict attention to equilibria where the principal uses pure strategies. It is possible that in some equilibria the principal may randomize over initiation or cancellation, but her randomization choices must be credible given the expert's report and/or the interim news. This means that the intuition we gain in equilibria where she uses pure strategies will go through and we will leave out those equilibrium where she randomizes for the sake of brevity.

2.3. A Benchmark: If the State was Always Revealed

Before discussing the main model, it is useful to check out the outcomes if the state always gets revealed, i.e. both when the reform and the *status quo* are chosen. We can use this case to compare our later results. In this benchmark case, when assessing the quality of the expert, the principal would ignore the interim news and simply compare the expert's recommendation with the true state. Both types of experts want to make the recommendation most likely to match the true state. So given the equal prior assumption, both types will report their signals truthfully through their messages in the influential equilibrium, which will be unique if it exists. (See 3.3 for details of the existence issue.)

Remark 1. *If the state is revealed regardless of the principal's choice of action, both types of experts always report their signals truthfully in the influential equilibrium.*

The proof follows the intuition outlined above and hence omitted here. It is available on request.

3. When the *Status Quo* Obstructs Knowledge

To keep the analysis tractable, we will assume that the sunk initiation cost $k > \frac{1}{2}$ in the main body. This assumption seems natural where the reform involves significant spending, e.g. an overhaul or a radical change of, say, the health care system or large infrastructure projects. We will briefly investigate the case where $k \leq \frac{1}{2}$ in section 5.1. Given the equal prior assumption and the fact that the return from a successful reform is $Y_R = 1$, $k > \frac{1}{2}$ implies that in any influential equilibrium the principal will start the reform if and only if the message is $m = 1$. Further, there can be only two types of influential equilibria. In the first one, after initiating the reform, the principal continues with it regardless of the interim news (hereafter called CE for Continuation Equilibrium). In the other one, after initiation, the principal reverts back to the *status quo* if and only if the interim news is bad (hereafter called DE for Discontinuation Equilibrium). However, an influential equilibrium does not necessarily exist for all parameter configurations. We will discuss the existence issue in section 3.3. Before that we will establish the experts' strategies in both types of equilibria, conditional on their existence.

First, we will establish the following lemma that greatly simplifies the analysis of experts' strategies.

Lemma 1. *An H-type expert truthfully reports his signals in any influential equilibrium that satisfies Conditions 1 and 2.*

The intuition is quite straightforward. A correct report enhances the expert's reputation while a wrong one lowers it as messages have their natural meanings. Now suppose in an equilibrium an H-type expert is indifferent between sending $m = 1$ and 0 after getting the signal $s = 1$. Then it must follow that an L-type expert always strictly prefers reporting $m = 0$ because he is less confident of the certainty of his signals. In that case, the principal would know for sure that the expert is of H-type whenever she gets the message $m = 1$. But then the H-type expert cannot be indifferent between his messages.

3.1. Continuation Equilibrium (CE)

Suppose the precision of the interim news is sufficiently low, so that once the reform is initiated, the principal will not revert back. (We defer the specification for the interim news to be 'sufficiently low' until 3.3.) Our first observation is that an L-type expert will not always report his signal truthfully in the CE. To appreciate the reason, suppose on the contrary that both types of experts report their signals truthfully. Then, if $m = 0$, the principal will not start the reform and so will never know the true state. Since the expert, whatever his type, tells the truth, the principal's posterior on expert type must be the same as the prior following $m = 0$. Now, when the L-type expert truthfully reports his signal $s = 1$, the principal would carry out the reform and when the recommendation appears wrong the expert will be exposed. Since the L-type expert knows his own type, he would strictly prefer deviating and reporting $m = 0$ instead. So we have the following proposition.

Proposition 1. *In the continuation equilibrium, an L-type expert truthfully reports $s = 0$ but misreports $s = 1$ with positive probability. That is, $t_{L0}^{c*} = 0$ and $t_{L1}^{c*} < 1$.*

The superscript $(^{c*})$ denotes the value of the variable in CE. We will use $(^{d*})$ for variable values in DE below. In general the superscript $(^{*})$ will be used to denote the equilibrium value of a variable.

3.2. Discontinuation Equilibrium (DE)

Suppose now that the interim news is sufficiently precise, so that the principal will cancel the reform if she gets a bad news. If she reverts back to the *status quo*, she will not know the true state for sure (unless $\beta = 1$). We can show that like in the case of CE, in a discontinuation equilibrium too, an L-type expert always tells the truth when $s = 0$ but misreports $s = 1$ with positive probability.

An interesting question is whether or not an L-type expert will recommend the reform more often in the DE than in the CE. We can show that $t_{L1}^{d*} > t_{L1}^{c*}$ for all $\beta < 1$. So the answer is yes. Note that only an L-type expert hides the signal $s = 1$ in equilibrium. Therefore, with the equal prior assumption, $m = 1$ is more likely to be sent by an H-type. Hence the L-type expert does have the signaling incentive to send this message when $s = 1$. However, it is costly for him to do so because a wrong recommendation would lower his reputation. In the CE, the principal would always find out if a pro-reform recommendation was mistaken. But in the DE, when the principal cancels the reform, she will not know with certainty whether the expert was right or wrong. Hence an L-type expert would find it more attractive to recommend the reform in the DE. Further, when β is smaller the principal is less sure about the true state after the cancellation, and so the incentive for an L-type expert to send $m = 1$ becomes larger. On the other hand, if $\beta = 1$, even if the principal cancels the reform, she would know for sure that the expert had fouled up. Hence $t_{L1}^{d*} = t_{L1}^{c*}$ if $\beta = 1$.

Proposition 2. *In the discontinuation equilibrium, an L-type expert*

1. *truthfully reports $s = 0$ and misreports $s = 1$ with positive probability ($t^{d*}_{L1} < 1$);*
2. *reports $m = 1$ more often than in the CE. That is, $t^{d*}_{L1} \geq t^{c*}_{L1}$, with strict inequality holding if $\beta < 1$;*
3. *reports $m = 1$ more often if the interim news is less precise. That is, $dt^{d*}_{L1}/d\beta < 0$.*

3.3. Existence of Influential Equilibria

We have identified the experts' strategies in both types of influential equilibria when they exist. Now, the existence of a particular type of equilibrium requires that the principal (i) starts the reform when $m = 1$ and (ii) reacts to the interim news in the way that is consistent with the requirement of the equilibrium.

We first assume that the principal has indeed started the reform at $T = 1$ and study her choice after the interim news. Given L-type experts' equilibrium strategy t^{j*}_{L1}, $j \in \{c, d\}$, the principal's belief that $\omega = 1$ at the time of starting the reform is

$$\alpha^{j*}_1 = \frac{r + (1-r)pt^{j*}_{L1}}{r + (1-r)t^{j*}_{L1}} \tag{1}$$

If now the interim news is g, the principal would know for sure that the reform will be successful and will continue with it. On the other hand, if the interim news is b, the principal revises her belief of $\omega = 1$ to

$$\alpha^{j*}_{1b} = \frac{\alpha^{j*}_1(1-\beta)}{1 - \alpha^{j*}_1\beta} \tag{2}$$

She will therefore cancel the reform if and only if $\alpha^{j*}_{1b} - (1 - \alpha^{j*}_{1b})c < 0$. Using (2), this is equivalent to

$$\beta > 1 - \frac{1 - \alpha^{j*}_1}{\alpha^{j*}_1}c \tag{3}$$

It will be useful to define a reference level of news precision

$$\beta_1 = 1 - \frac{1 - \alpha^{c*}_1}{\alpha^{c*}_1}c \tag{4}$$

If the L-type expert uses the CE reporting strategy, the principal will continue with the reform in spite of bad interim news if and only if $\beta \leq \beta_1$. Note that for a given level of p, β_1 is a well-defined constant since an L-type expert's strategy (and consequently,

α_1^{c*}) in the CE is independent of β. (But the value of β_1 does depend on p. We suppress this dependence in our notation for clarity of exposition.) For the welfare analysis of the next section to be meaningful, we would like to make sure that in the CE, the L-type expert recommends the reform with positive probability.[9] The following assumption would ensure this. (Please refer to the proof of Proposition 1.)

Assumption 1. $p > \frac{r}{2-r}$

Now suppose that the L-type expert uses the DE strategy. Note that $\alpha_1^{d*} < \alpha_1^{c*}$ for all $\beta < 1$. (In the DE, α_1^{d*} depends on β, but we suppress this in our notation again for the sake of exposition.) The principal is less confident that $\omega = 1$ in the DE because the L-type expert is now more likely to report his signal $s = 1$ ($t_{L1}^{c*} \leq t_{L1}^{d*}$). It is then clear from (4) that the constant β_1 is larger than $1 - \frac{1-\alpha_1^{d*}}{\alpha_1^{d*}}c$. Therefore, if the L-type expert uses the DE strategy, the principal will cancel the reform after getting a bad news for all $\beta \geq \beta_1$. In addition, due to continuity, she will also call off the reform following an unfavorable news for β "not too far" below β_1. This implies that there can be both types of influential equilibria for intermediate values of β just below β_1 depending on the "coordination" of the players.[10]

We now turn to the principal's initiation choice at $T = 1$. Suppose the expert uses the DE strategy and (3) holds at $T = 2$. The principal expects to cancel the reform if the interim news is unfavorable. Her expected payoff by initiating the reform is

$$W_D = \alpha_1^{d*}\beta - k \tag{5}$$

[9]If $t_{L1}^{c*} = 0$, we have $\beta_1 = 1$ so that as long as the the players 'coordinate' on the CE strategies (see below for the multiple equilibria problem), the introduction of the interim news cannot have any impact on the decision-maker's welfare and hence our welfare question becomes moot.

[10]It may be asked if we can establish a unique $\beta_0 = 1 - \frac{1-\alpha_1^{d*}}{\alpha_1^{d*}}c$, so that if the L-type expert uses the DE strategy, the principal cancels the reform *if and only if* $\beta > \beta_0$. The difficulty for this is that t_{L1}^{d*} itself is a function of β in the DE. In particular, as β increases, t_{L1}^{d*} decreases (and thus $1 - \frac{(1-\alpha_1^{d*})c}{\alpha_1^{d*}}$ increases) as per the previous proposition. It is clear there must exist a lower bound for β below which the DE cannot exist (it certainly does not if $\beta \to 0$). However, we cannot prove analytically that such β_0 is unique, although numerical simulation does suggest it is. (The result will be true if one can show that $\frac{d^2 t_{L1}^{d*}}{d\beta^2} < 0$.) We leave this question open as it does not qualitatively impact on our main investigation.

On the other hand, if the expert uses the CE strategy and (3) does not hold at $T = 2$, the principal expects to disregard bad interim news and pursue the reform to the end, and her expected payoff from its initiation is

$$W_C = \alpha_1^{c*} - (1 - \alpha_1^{c*})c - k \tag{6}$$

For at least one type of influential equilibrium to exist, we need

$$\max\{W_D, W_C\} > 0 \tag{7}$$

The next assumption would ensure that for all β, inequality (7) is satisfied so that at least one type of influential equilibrium exists.

Assumption 2. $r + (1 - r)p > \frac{c+k}{1+c}$

Given these assumptions we can now summarize the existence results for influential equilibria.

Proposition 3. *Let assumptions 1 and 2 hold and let β_1 be defined as in (4).*

1. *A CE exists if and only if $\beta \leq \beta_1$.*
2. *There exists some $\beta_L < \beta_1$ such that for all $\beta > \beta_L$, a DE exists.*

Figure 1 below gives an example that illustrates the dependence of an L-type expert's recommendation strategy on β as well as the existence of influential equilibria.

4. Welfare and Delegation

4.1. When Second Opinions Hurt

We will now address the central concerns of this paper: what are the effects of the interim news on the principal's welfare? The first question is whether the principal at all benefits from having access to an interim news of some given precision β. In this case we may imagine as if there was an extra 'Stage 0' before the game started. In this stage the principal can make an irreversible decision on whether to use the interim news or ignore it altogether. For example, a government may choose (not choose) to set up a

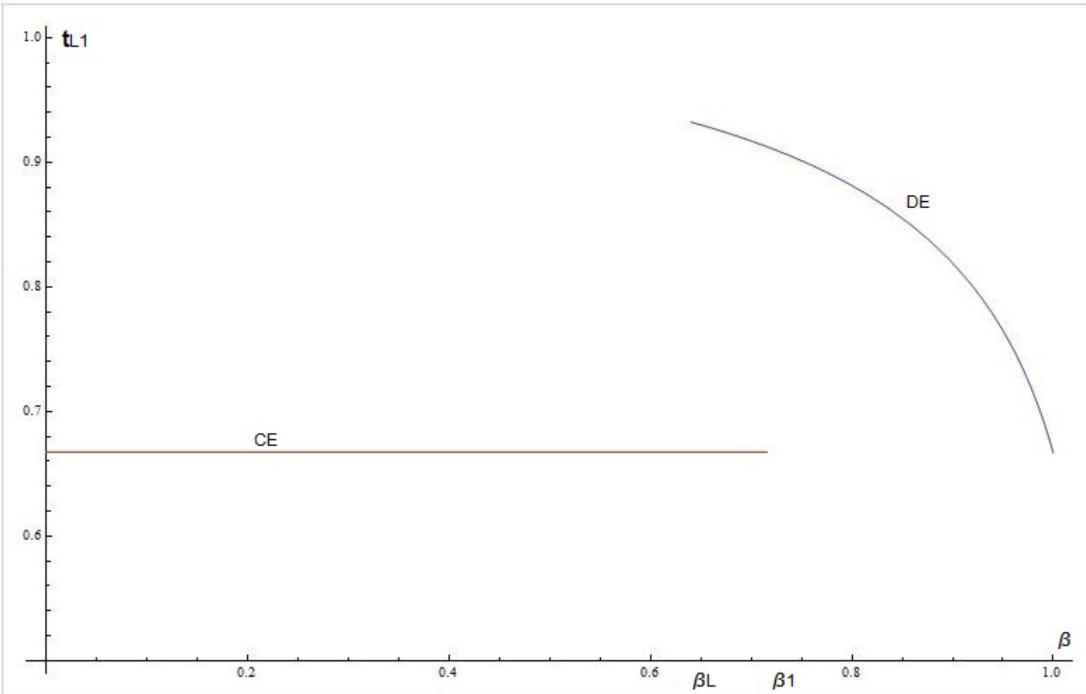

Figure 1: Here $p = 0.6$, $r = 0.5$, $c = 1.4$ and $k = 0.5$. In the CE, which exists for $\beta < \beta_1$, t_{L1}^{c*} is a constant. The DE exists for $\beta > \beta_L$. Note that $t_{L1}^{d*} \geq t_{L1}^{c*}$ and $dt_{L1}^{d*}/d\beta < 0$.

monitoring body that provides interim feedback on the progress of the reform. It turns out that the exogenously given quality of the news β would be crucial in this decision.

Clearly, if the quality of the interim news is very poor (p small) so that players remain in the CE after its introduction, the principal's welfare is unaffected. However, if the introduction of the interim news results in a switch from the CE to the DE, the L-type expert will now recommend the reform more often. Recall that the principal starts the reform at $T = 1$ only if the expert's message is 1. If this recommendation actually comes from an L-type expert, the principal will obtain the positive payoff 1 only when both the expert advice and the interim news are correct. The probability of such an event is $p\beta$. Since the reform incurs a non-refundable sunk cost k, the principal will benefit from an L-type expert's more frequent pro-reform recommendation if and only if $p\beta > k$.

To get a more concrete idea we will first focus on the reference value of $\beta = \beta_1$. This value is important for two reasons. First, the introduction of an interim news would always result in the DE if $\beta > \beta_1$; so there is no ambiguity about the principal's welfare from possible multiplicity of equilibria. Second, if experts follow the CE reporting-strategy, at β_1 the principal is just indifferent between canceling and continuing the reform when $n = b$. Therefore, at $\beta = \beta_1$ any change in the principal's welfare comes entirely from the increase in the frequency of the L-type expert's reform message. As discussed above, the principal would benefit from it if and only if $p\beta_1 > k$. To get the definitive results presented in the next proposition, we will impose a regularity assumption which ensures that $\frac{\partial \beta_1}{\partial p} > 0$. Effectively it assumes that the proportion of H-type experts, r, is not too large. We denote this value of r by r^*. Numerically, r^* is just above 0.47.[11]

Assumption 3. *Let $r < r^*$.*

We now have the following proposition.

Proposition 4. *Let assumptions (1)- (3) hold.*[12] *There exists a unique $\hat{p} \in (k, \frac{c+k}{1+c})$ such that*

1. *For all $p < \hat{p}$, there is some $\beta_M(p) > \beta_1$ such that, the principal's welfare is strictly less when she has access to the interim news if and only if $\beta \in (\beta_1, \beta_M(p))$.*
2. *When $p \geq \hat{p}$, having access to the interim news will strictly improve the principal's welfare for all $\beta > \beta_1$.*

When the state is not observable in the *status quo*, the principal will surely be worse off if the L-type expert's quality is poor and the precision of the interim news too is not far above β_1. On the other hand, if the expert's quality is sufficiently good, having

[11] In general, β_1 is not always monotonically increasing in the entire range of $p \in (0.5, 1)$. This is because an increase in p has two effects: it makes the L-type expert's signal more precise, but it also encourages him to report his $s = 1$ signal more often. So the overall effect on the DM's belief α_1^{c*} can be ambiguous. It turns out that a sufficient condition for $\frac{\partial \beta_1}{\partial p} > 0$ is

$$r < \frac{2p}{(1-p)^2}[\sqrt{1 + (1-p)^2} - 1]$$

r^* is defined as the minimum of the RHS. The RHS is increasing in p for all $p \in (0.5, 1)$ and its minimum when $p = 0.5$ is just over 0.47.

[12] A qualitatively similar result holds if we dispense with assumption 3. The first part of proposition 4 holds for $p < k$ and the second part holds for $p > \frac{c+k}{1+c}$. But for $p \in (k, \frac{c+k}{1+c})$ we cannot establish a unique cutoff $\hat{p}$ as in the proposition. Please refer to the proof for more details.

access to any interim news above β_1 will benefit the principal.Figure 2 illustrates the proposition with an example.

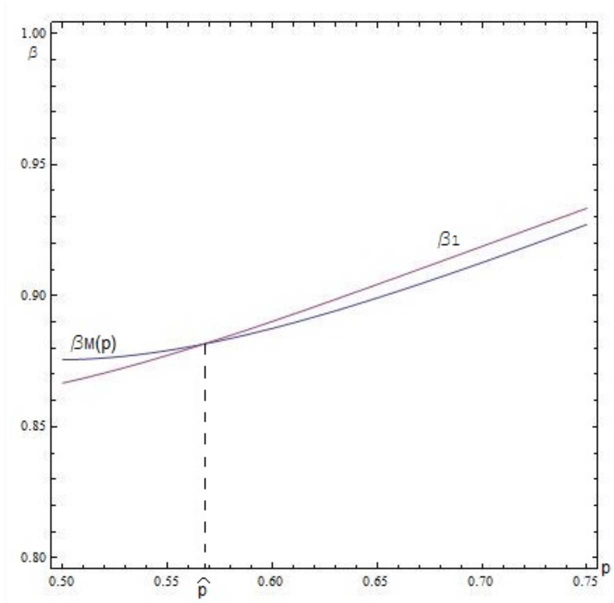

Figure 2: Here, we take $k = 0.5$, $c = 0.5$ and $r = 0.4$. The principal's welfare is higher in the DE than in the CE if and only if β lies above the $\beta_M(p)$ curve. When $p < \hat{p}$, the curve $\beta_M(p)$ is above β_1, so that the principal will be worse off with an interim news if $\beta_1 < \beta < \beta_M(p)$. On the other hand, for all $p > \hat{p}$, she is always better off when $\beta > \beta_1$. (We did not plot those p larger than 0.75 so that the position of the curves can be seen more clearly.)

The above proposition characterizes the welfare effects of interim news with precision exceeding β_1. Some observations for the range $\beta \leq \beta_1$ can be deduced as corollary. Clearly, if CE is the only equilibrium for a value of $\beta \leq \beta_1$, having access to the interim news or not is immaterial for the principal's welfare. Hence, we will restrict attention to $\beta \in (\beta_L, \beta_1]$ where multiple influential equilibria exist according to Proposition 3. Assume that if the principal decides to use the interim news at stage 0, the players 'coordinate' on the DE. In this case, if $p < \hat{p}$, the principal would be harmed by the interim news even more because an L-type expert would be encouraged to recommend the reform even more often. On the other hand when $p > \hat{p}$, it follows by continuity (from the second part of the last proposition) that the principal is better off when β is not too far below β_1.

Corollary 1. *Let $\beta \in (\beta_L, \beta_1]$ and assumptions (1)-(3) hold. Assume that when the* *principal avails the interim news, players coordinate on the DE.*

1. *If $p < \hat{p}$, the principal is strictly worse off by gaining access to the interim news.*
2. *If $p > \hat{p}$, there exists some $\beta_m(p) \in [\beta_L, \beta_1)$ such that for all $\beta \in (\beta_m(p), \beta_1]$, the principal is strictly better off by gaining access to the interim news.*

It is worthwhile to note that the (in)ability of the principal to commit to a particular action after getting the interim news is crucial to her welfare. When $p < \hat{p}$ and $\beta \in (\beta_L, \beta_M(p))$, her welfare is reduced as she is unable to continue with the reform in the face of an unfavorable news. The reason, as we have seen, is that it induces an L-type expert to recommend the reform more aggressively. On the other hand, when $p > \hat{p}$ and $\beta \in (\beta_m(p), \beta_1]$, if the principal can commit to canceling the reform after a bad news, she can exploit the advantage of the interim news by coordinating with the expert on the DE and encourage him to make pro-reform recommendation.

4.2. Optimal Interim News

The above analysis shows that when the expert's information is of very poor quality, the principal can be harmed by availing an interim news. That would happen if the quality of the interim news is in a certain intermediate range. This observation arose when analyzing a binary issue: whether to use an interim news of a given quality or not. However there are scenarios where the principal can actively influence the quality of the interim news. For example, the news may be researched and processed by government departments or private consulting firms, and the government might be able to improve its quality by hiring more qualified staff, choosing among consulting firms or making other forms of investment. In this scenario it is useful to ask: even when an interim news produces benefit, would the principal be better off as the interim news becomes more and more precise? Is $\beta = 1$ the optimal quality of interim news? In order to focus on the effect of β alone, we will assume that it is costless to increase its value.

A marginal increase of β has no effect on the principal's welfare in the CE. Therefore we will focus on the principal's payoff in the DE, which we denote by V_D^*. (See the proof of proposition 4 for a discussion of V_D^*.). The marginal effect of β on V_D^* is:

$$\frac{dV_D^*}{d\beta} = \frac{1}{2}[r + (1-r)pt_{L1}^{d*}] + \frac{1}{2}(1-r)(p\beta - k)\frac{dt_{L1}^{d*}}{d\beta} \tag{8}$$

The equation shows that any increase in β produces two effects. First, *given the expert's recommendation strategy*, an increase in β means that a correct reform decision is less likely to be reversed by a misleading interim news. Second, there is a strategic effect: as β increases, L-type experts are less likely to make pro-reform recommendation. Recall that the principal prefers L-type experts to truthfully report the signal $s = 1$ if and only if $p\beta > k$. When $p < k$, the principal does not want an L-type expert to recommend the reform at all and the strategic effect is positive for her welfare as $\frac{dt_{L1}^{d*}}{d\beta} < 0$. In this case, a higher β is always beneficial to the principal. However, when p is sufficiently large so that $p\beta > k$, the overall effect becomes ambiguous. The principal may not benefit from increase of β all the way to 1. Large β may excessively discourage an L-type expert from recommending the reform. We cannot produce an analytical condition as necessary and sufficient for welfare to be decreasing in β because of irregular properties of the underlying functions. However, we have worked through numerical simulations showing welfare peaking at values of $\beta < 1$. As an illustration we produce a plot of the principal's payoff against β where $k = 0.55$, $p = 0.7$ and $r = 0.8$.

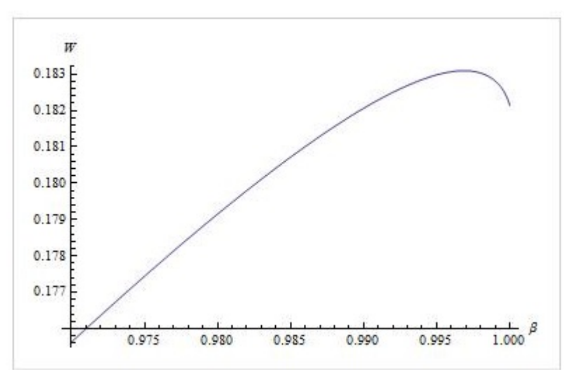

Figure 3: The marginal effect of β on V_D

We summarize this discussion in the following proposition.

Proposition 5. 1. *When $p \leq k$, the optimal level of β for the principal is* 1.

2. *When $p > k$, it is possible that the optimal β is less than* 1.

The Proof of the first part follows from the above discussion. That of the second part comes from simulations as illustrated by the numerical example.

We will like to contrast these welfare results against the benchmark case where the state always gets revealed. There both types of experts always report truthfully no matter how the principal is expected to react to the interim news. Denote by α_1^{B*} the principal's belief that $\omega = 1$ after getting a pro-reform recommendation in the benchmark case. From (1), $\alpha_1^{B*} = r + (1-r)p$ and the principal will cancel the reform following a bad interim news if and only if

$$\beta > 1 - \frac{(1-\alpha_1^{B*})c}{\alpha_1^{B*}} \tag{9}$$

Since experts' strategies will remain the same for all values of β, it is clear that the principal cannot be worse off with the interim news. Further, if she acts according to the interim news, her payoff must be strictly increasing in β.

Remark 2. *If the state is always revealed,*

1. *Having access to the interim news never hurts the principal and strictly increases her welfare if* (9) *holds.*
2. *In the DE, a marginal increase in* β *strictly increases the principal's welfare and the optimal level of* β *is 1.*

The proof directly follows from the above discussion and is omitted.

4.3. Delegation

As we have seen, the principal's reaction to the interim news is crucial in determining the expert's recommendation, which in turn affects the principal's payoff. The above analysis suggests that the principal can improve her payoff by pre-committing to particular actions, thereby inducing the expert to report in a way that is better for her. One way of doing this is to delegate the decision right to another decision-maker who is known to have a different preference about the reform/action.[13] For concreteness, we can think of the principal as a government whose costs and benefits are the same as that

[13] We may ask what happens if the principal delegates the decision rights to the expert. In our model, the expert cares only about his reputation. Therefore, there cannot be an informative/influential equilibrium where in the second period the L type expert himself cancels the reform after a bad news for any $\beta < 1$. Doing so would expose his ignorance. This shows the importance of separating the expert

of the population. To counter the effects of experts' strategic behavior, the government can appoint a 'well-known' official to take charge of the decisions regarding a particular reform. The official is known to favour the reform in question or is much against it as the case may be, and so would bear a significantly different personal cost compared with the public if the reform fails.[14] Delegation of this kind as a mechanism for pre-commitment in reputational cheap talk games has been discussed in a previous work by Sanyal and Sengupta (2008). The model of that paper however does not study the effect of interim news or second opinion.

To develop the argument we imagine that there is a continuous pool of potential decision-makers who share the same benefit and initiation cost as the principal, but differ in terms of their respective failure cost c_j, which is distributed over $[0, +\infty)$. We have seen that for $p < \hat{p}$ and $\beta \in (\beta_L, \beta_M(p))$, the principal would benefit by committing to ignore the interim news. Therefore, if institutional arrangements permit, she would be better off by delegating the decision rights to a person with $c_j < c$. Conversely, let $p > \hat{p}$ and $\beta \in (\beta_m(p), \beta_1]$ as defined in Corollary 1. Suppose for concreteness, that the players are stuck in the CE. The principal would then be better off by delegating the decision rights to someone with $c_j > c$ thus committing to cancel the reform if there is a bad news.

Proposition 6. *Let assumptions (1)-(3) hold.*

1. *If $p < \hat{p}$, whenever the interim news makes the principal worse off, she will be better off delegating the decision to a decision-maker with $c_j < c$.*
2. *If $p > \hat{p}$, and $\beta \in (\beta_m(p), \beta_1]$, if originally the players are in the CE, the principal will be better off delegating the decision to a decision-maker with sufficiently large $c_j > c$.*

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and the decision-maker for our paper. In addition, the initiation strategy of the expert in the first period would be the same as that in the CE identified in our model. A model where the expert himself makes all the decision in a multi-stage setting has been studied by Majumdar and Mukand (2004).

[14] Governments are seen to appoint politicians or public officials for specific actions, who are known as hawkish or dovish in relation to the action. Quite clearly they do not represent the median voter's opinion on the action.

5. Discussion

This section discusses the structural features of our model and major assumptions. The purpose is to clarify their analytical role as also to discuss the robustness of the results of the paper in relation to these assumptions and features.

5.1. When $k \leq \frac{1}{2}$

Return from the successful action/reform has been normalized as 1 in our model. This provides a scale for fixing the value of k, the irrecoverable expenditure of the action. If $k \leq \frac{1}{2}$ there is an extra type of influential equilibrium, which we may give the name of 'initiation equilibrium' (IE). In this equilibrium the principal would initiate the reform regardless of the message. She would then revert back to the *status quo* if and only if the interim news $n = b$ *and* the message sent by the expert was $m = 0$ at $T = 1$. To save space, we will briefly explore the intuition behind the equilibrium strategy of the L-type expert, denoted by t^{I*}_{Ls} and the welfare implication of the interim news. (H- type expert still tells the truth. The proof for this is similar to that for Lemma 1.) A detailed mathematical analysis can be available upon request.

First, the IE arises only if the interim news is available. Otherwise, the only influential equilibrium clearly is still the CE as before. Now suppose the interim news is available. If k is sufficiently small, even when the expert advises against the reform, the principal is willing to initiate it and cancel it only after a subsequent bad news. Indeed, when $k = 0$, it becomes weakly dominant for her to do so. Since there is a positive probability that the principal will find out the true state in the IE even if the expert recommends $m = 0$, it becomes less attractive for the L-type expert to lie when his signal is $s = 1$. Therefore, compared to the CE, he now advises the reform more often, i.e., $t^{I*}_{L1} \geq t^{c*}_{L1}$. (But he would still truthfully report $s = 0$.) Further, as β increases, the principal is more likely to learn the true state, which further decreases the expert's lying incentive so that we have $\frac{dt^{I*}_{L1}}{d\beta} > 0$. We should note that an L-type expert recommends the reform more often in the IE for a reason that is exactly opposite of that in the DE. In the DE, the fact that the principal cancels the reform after a bad interim news *prevents* her from learning the true state. This emboldens an L-type expert to send more pro-reform recommendations, which is a signal of being smart. Further we had $\frac{dt_{L1}^{d*}}{d\beta} < 0$ in the DE, as the principal has a better idea about the true state as β increases.

The welfare effect of the interim news follows similar lines as in our original analysis. In the IE, the failure cost c cannot be avoided if the message is $m = 1$ as the principal will continue the reform whatever interim news follows it. So the principal can benefit from more frequent pro-reform recommendations from an L-type expert only if p is sufficiently large relative to c and k. In fact, even when $k = 0$, it is possible that the principal is worse off by having access to the interim news, as demonstrated by the following example.

Let $p = 0.51$, $r = 0.65$, $c = 5$ and $k = 0$. First let $\beta = 0$. The only possible influential equilibrium is the CE, in which $t_{L1}^{c*} = 0.108$ and the expected welfare of the principal is $V_C^* = 0.289$. Now let $\beta = 0.45$. The CE is impossible because $k = 0$ and $\beta > 0$. In the IE, one can check that $t_{L1}^{I*} = 0.390$. It can be calculated that the expected payoff of the principal is $V_I^* = 0.256 < V_C^*$.

5.2. Simultaneous Reporting

Our model has a time line punctuated by the sequential arrival of two messages. The expert's message arrives at $T = 1$, while the interim news becomes available at $T = 2$. We should check what role this time line plays. Consider an alternative environment where the expert and the source of the interim news simultaneously announce their messages. In this setup the initiation cost k and the failure cost c of our model can be combined into a single cost item after proper re-scaling of the payoff.

One crucial difference is that in the alternative simultaneous reporting setting, the principal can always obtain both messages. In our two-stage model, by reporting $m = 0$, the expert can prevent the principal from starting the reform and consequently, getting the interim news. We believe this setup is suitable for capturing many real life situations where the appropriateness of an action can not be judged without proceeding some way along it. Second, the two-stage setup and the sunk cost are crucial to the central welfare results of Propositions 4 and 5. To see this, suppose in the simultaneous reporting model the expert originally uses the CE reporting strategy. Now if we increase β beyond β_1 as defined in (4) (accounting for the fact that the failure cost c has been rescaled), the principal will never initiate the reform if $n = b$ no matter what the expert recommends.

This implies that the interim news is so precise that the expert's recommendation is not of any relevance. (The principal will always start the reform after $n = g$.) Hence the fact that the L-type expert might change her reporting strategy has no impact on the principal's welfare for all $\beta > \beta_1$.[15] Also, unlike our observation in Proposition 5, the optimal level of β is always 1 even when the state is not observed, because no matter what the expert reports, he cannot prevent the principal from accessing the additional information.

5.3. Unequal Priors and Symmetric Information

Our assumption that *a priori* the states are equally likely means that an H-type expert is equally likely to get both signals. Therefore getting a particular signal is not an indication of smartness. Hence, an L-type expert has an incentive to recommend the *status quo* only because he is less likely to be exposed if it is chosen. With unequal prior, an H-type expert is more likely to see one signal than the other; hence the L-type expert's signalling incentive gets more complicated. However, he will still recommend the *status quo* more often than he actually observes $s = 0$, as long as the prior is not too heavily biased towards $\omega = 1$.

Let $\pi \in (0, 1)$ be the prior that $\omega = 1$. If $\pi < \frac{1}{2}$, an H-type expert is more likely to receive $s = 0$. Therefore, reporting $m = 0$ is a signal of being an H-type and this increases the incentive for an L-type expert to recommend the *status quo* even further. The opposite argument would indicate that if $\pi > \frac{1}{2}$, it will be less attractive for the L-type expert to misreport his $s = 1$ signal. But by continuity, if π is not too far above $\frac{1}{2}$, the incentive of hiding his ignorance is still dominant.

On the other hand, the assumption of asymmetric information is quite important for the results of this paper. This is because experts' signalling incentives in our model arise from the fact that they know their types. A number of contributions in the literature show that the outcome of reputational cheap talk games depend on whether the information

[15] In this set up, the result that the principal can be worse off when the introduction of the interim news changes the expert's behavior has to rely on the existence of multiple equilibira for intermediate $\beta < \beta_1$. In the two-stage model, as Proposition 4 shows, the result does not depend on such multiplicity at all when $\beta > \beta_1$.

about experts' type is symmetric. (See Li (2007) and Levy (2004) for example.) Results of our paper will change quite drastically if the expert does not know his own type, and if we further dispense with the equal prior assumption. In particular, for $k > \frac{1}{2}$, we can show that a slight bias in the prior belief towards the *status quo* will lead to complete disappearance of any influential equilibrium. See Brandenburger and Polak (1996) and Liu (2011) for more detailed investigation of this phenomenon.

5.4. If the Expert Has Some Concern for the Reform's Outcome

If experts also care about the principal's welfare, i.e., the reform's outcome, the misreporting incentive of L-type experts will fall. An L-type expert's reporting strategy t^*_{L1} in influential equilibria will move closer to what is better for the principal. For example, in the DE, the principal would like the L-type expert to always report truthfully if $p\beta > k$. Otherwise, she would prefer that he never recommends the reform. The incentive from the expert's concerns about the reform outcome or principal's welfare also works in the same direction. Therefore, compared to the situation where the expert cares only about his reputation, now in the DE, t^{d*}_{L1} is larger (resp. smaller) if $p\beta$ is greater (resp. smaller) than k. This would make the principal better off. However, results of the paper will not change qualitatively if the expert does not put too much weight on the outcome of the reform.

6. Summing Up

We have presented a reputational cheap talk model where, after initiating a reform recommended by the expert, the principal receives an independent second opinion/news and has the option of returning to the *status quo*. The *status quo* however does not produce any information about what the true state is. The two-stage set-up, the separation of the expert with career concerns from the decision-maker, and the uninformativeness of the *status quo* are crucial features that we wanted to incorporate in the analysis, as we think they characterize many important decision-making situations. They are also crucial to the results obtained in the paper.

The principal's decision about continuing or discontinuing the reform after the interim news has pronounced effects on the expert's recommendation. If the principal retracts the reform, the expert who recommended it would escape being fully marked down when the advice is inappropriate. This encourages those experts who are not too sure of what they recommend, to advise the reform more often than otherwise. This act of posturing by less informed experts is the focus of this paper. We have shown that the availability of an interim news/second opinion is not unambiguously better for the principal. And, when it is better, it is not necessarily the case that an improvement of its precision would increase the principal's payoff further.

The model highlights the importance of the principal's commitment to specific actions for influencing experts' strategy. It also identifies the delegation of decision-making as a pre-commitment mechanism by the principal when the existence and quality of the interim news is outside her control. By delegating to actors with well-known preferences, the principal/government is sometimes able to signal pre-commitment to a particular line of action regarding the interim news. This provides a plausible line of thinking about appointments done by governments regarding specific reforms and cases of apparently unreasonable persistence or about-turn with policies and reforms.

Acknowledgement

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A. Proofs

We will denote the information available to the principal at the end of the game by $I = \{m, \hat{\omega}, \hat{n}\}$. The principal always gets a report m from the expert. Her information about the true state of the world is denoted by $\hat{\omega} \in \{1, 0, \oslash_\omega\}$. If she initiates the reform and sticks to it until the end, she will know the true state by observing the return. ($\widehat{\omega} = 1$ if and only if $Y = 1$.) If the reform is not initiated or canceled after the interim news, the principal will not know the true state (hence $\hat{\omega} = \oslash_\omega$). The possible interim news the principal might receive is denoted by $\hat{n} \in \{g, b, \oslash_n\}$. If the principal has chosen the *status quo* at the beginning, she would not receive any news so $\hat{n} = \oslash_n$.

We use $U_{is}(m)$ to denote the i-type agent's expected payoff from reporting m when he gets the signal s.

A.1. Lemma 1

A general proof over all parameter ranges is cumbersome due to the fact that the expression for the expert's reputational payoff depends on the principal's choices. Here we will provide the proof for $k > \frac{1}{2}$, which is the case studied in detail in the text. We also concentrate on the Discontinuation Equilibrium and the case where the state is not revealed after choosing *status quo*. The case for the Continuation Equilibrium is proved in a similar way.

Proof. First note that since $k > \frac{1}{2}$, the principal will never initiate the reform if $m = 0$. On the other hand, the definition of influential equilibrium requires that she always starts the reform when $m = 1$. The expected payoff of the experts are

$$U_{Hs}(0) = U_{Ls}(0) = \hat{r}(0, \oslash_\omega, \oslash_n) \text{ for } s = 0, 1$$

$$U_{H1}(1) = \beta\hat{r}(1, 1, g) + (1 - \beta)\hat{r}(1, \oslash_\omega, b)$$

$$U_{L1}(1) = p\beta\hat{r}(1, 1, g) + [p(1 - \beta) + (1 - p)]\hat{r}(1, \oslash_\omega, b)$$

$$U_{L0}(1) = (1 - p)\beta\hat{r}(1, 1, g) + [(1 - p)(1 - \beta) + p]\hat{r}(1, \oslash_\omega, b)$$

It can be shown that $\hat{r}(1, 1, g) > \hat{r}(1, \oslash_\omega, b)$ if and only if $\hat{r}(1, 1, g) > \hat{r}(1, 0, b)$.[16] We first claim that an H-type expert does not randomize when his signal is $s = 1$. Suppose to the contrary he does so. This would imply that $U_{H1}(0) = U_{H1}(1)$. If $\hat{r}(1, 1, g) > \hat{r}(1, \oslash_\omega, b)$,

[16]To see this, we may explicitly write out the relevant expressions.

$$\hat{r}(1, 1, g) = \frac{rt_{H1}}{rt_{H1} + (1 - r)[p_L t_{L1} + (1 - p_L)t_{L0}]}$$

$$\hat{r}(1, 0, b) = \frac{rt_{H0}}{rt_{H0} + (1 - r)[(1 - p_L)t_{L1} + p_L t_{L0}]}$$

$$\hat{r}(1, \oslash_\omega, b) = \frac{rt_{H0} + (1 - \beta)rt_{H1}}{rt_{H0} + (1 - r)[(1 - p_L)t_{L1} + p_L t_{L0}] + (1 - \beta)[rt_{H1} + (1 - r)[p_L t_{L1} + (1 - p_L)t_{L0}]]}$$

Some simple algebraic manipulation shows the claim is true.

we must have

$$U_{L0}(1) < U_{L1}(1) < U_{H1}(1) = U_{H1}(0) = U_{L1}(0) = U_{L0}(0)$$

in which case, an L-type expert will never report $m = 1$. But then $U_{H1}(1) = 1 > U_{H1}(0)$. A similar argument shows that it is impossible to have $\hat{r}(1, 1, g) < \hat{r}(1, \oslash_\omega, b)$ as the L-type expert will never report $m = 0$. Finally consider $\hat{r}(1, 1, g) = \hat{r}(1, \oslash_\omega, b)$. This would imply that

$$\hat{r}(1, 1, g) = \hat{r}(1, \oslash_\omega, b) = \hat{r}(1, 0, b) = \hat{r}(0, \oslash_\omega, \oslash_n)$$

Note the last equality follows because $U_{H1}(0) = U_{H1}(1)$, as we assumed the H-type randomizes at $s = 1$. But this means that the principal's posterior belief of the expert's type never changes and violates condition 2 of the influential equilibrium. Hence we have proved that an H-type expert does not randomize if $s = 1$. A similar argument will establish that he cannot randomize when $s = 0$, either. The lemma then follows because we ignore 'mirror equilibria' by assumption. ■

A.2. Proposition 1

Proof. First note that the principal's posterior assessments of the expert given the latter's strategies, are

$$\hat{r}(1, 0, b) = 0 \text{ [17]} \tag{10}$$

$$\hat{r}(1, 1, \hat{n}) = \frac{r}{r + (1-r)(pt^c_{L1} + (1-p)t^c_{L0})} \tag{11}$$

$$\hat{r}(0, \oslash_\omega, \oslash_n) = \frac{r}{r + (1-r)(2 - t^c_{L1} - t^c_{L0})} \text{ [18]} \tag{12}$$

We first establish that $t^{c*}_{L0} = 0$. Suppose on the contrary $t^{c*}_{L0} > 0$. This means, for an L-type expert,

$$U_{L1}(1) = p\hat{r}(1, 1, \hat{n}) > (1-p)\hat{r}(1, 1, \hat{n}) = U_{L0}(1) \geq \hat{r}(0, \oslash_\omega, \oslash_n) = U_{L0}(0)$$

[17] Strictly speaking, since we assume that an H type expert gets perfect signals, we need to consider the off-equilibrium event: $t^{c*}_{L1} = 0$, the principal receives $m = 1$ but the output is $Y = -c$. We assume that in this case, the principal believes that the message comes from the L-type expert.

[18] To understand the denominator, note that if the expert is L-type, in state 1, he sends $m = 0$ with probability $p(1 - t^c_{L1}) + (1-p)(1 - t^c_{L0})$. In state 0, he sends $m = 0$ with probability $p(1 - t^c_{L0}) + (1 - p)(1 - t^c_{L1})$. The expression then follows from our assumption that each state is equally likely.

So $t_{L1}^{c*} = 1$. But then one can check that, for all $t_{L1}^{c*} > 0$,

$$p\hat{r}(1,1,\hat{n}) = \frac{pr}{r + (1-r)(p + (1-p)t_{L0}^{c*})} < \hat{r}(0, \oslash_\omega, \oslash_n) = \frac{r}{r + (1-r)(1 - t_{L0}^{c*})}$$

and we have a contradiction. Hence $t_{L0}^{c*} = 0$.

Now suppose the L-type expert gets $s = 1$. Given $t_{L0}^{c*} = 0$, his expected payoffs from reporting $m = 1$ and $m = 0$ are, respectively,

$$U_{L1}(1) = p\hat{r}(1,1,\hat{n}) + (1-p)\hat{r}(1,0,b) = \frac{pr}{r + (1-r)pt_{L1}^{c}}$$

$$U_{L1}(0) = \hat{r}(0, \oslash_\omega, \oslash_n) = \frac{r}{r + (1-r)(2 - t_{L1}^{c})}$$

When $t_{L1}^{c} = 1$, $U_{L1}(1) < U_{L1}(0)$ since $p < 1$. Hence in the CE $t_{L1}^{c*} < 1$. In equilibrium the L-type expert randomizes at $s = 1$ if and only if there exists a $t_{L1}^{c*} \in (0,1)$, such that

$$\frac{pr}{r + (1-r)pt_{L1}^{c*}} = \frac{r}{r + (1-r)(2 - t_{L1}^{c*})} \tag{13}$$

It is easy to verify that if $p > \frac{r}{2-r}$, there exists a unique $t_{L1}^{c*} = 1 - \frac{r(1-p)}{2p(1-r)}$ such that the above holds as equality. If $p \leq \frac{r}{2-r}$, the above can never hold for any $t_{L1}^{c*} > 0$.[19] ■

A.3. Proposition 2

Proof. First note that if the principal cancels the reform after a bad news, her belief about the expert's type is

$$\hat{r}(1, \oslash_\omega, b) = \frac{r(1-\beta)}{r(1-\beta) + (1-r)[(pt_{L1}^{d} + (1-p)t_{L0}^{d})(1-\beta) + ((1-p)t_{L1}^{d} + pt_{L0}^{d})]} \tag{14}$$

We will omit the proofs for $t_{L0}^{d*} = 0$ and $t_{L1}^{d*} < 1$ as they are very similar to that in Proposition 1. As in proposition 1, the value of t_{L1}^{d*} is determined by equating the expert's expected payoff of reporting $m = 1$ and $m = 0$, when $s = 1$. They are respectively,

$$\begin{aligned} U_{L1}(1) &= p\beta\hat{r}(1,1,\hat{n}) + (1-p\beta)\hat{r}(1, \oslash_\omega, b) \\ &= \frac{p\beta r}{r + (1-r)pt_{L1}^{d*}} + \frac{(1-p\beta)r}{r + (1-r)[p + \frac{1-p}{1-\beta}]t_{L1}^{d*}} \end{aligned}$$

[19] The result that $t_{L1}^{c*} = 0$ for all $p \leq \frac{r}{2-r}$ is due to our assumption that the H type expert gets a perfect signal and the belief off the equilibrium discussed in footnote 16. If we assume instead the H type expert also has noisy information, with $p_L < p_H < 1$, in equilibrium we have $0 < t_{L1}^{c*} < 1$, $t_{L0}^{c*} = 0$ and the H type always reports truthfully. The idea of the proof is identical to Lemma 1 and the current proposition.

$$\text{and} \;\; U_{L1}(0) = \frac{r}{r + (1-r)(2 - t_{L1}^{d*})}$$

It is easy to see that $\frac{\partial U_{L1}(1)}{\partial t_{L1}^{d*}} < 0$ and one can verify, after some algebra, that $\frac{\partial U_{L1}(1)}{\partial \beta} < 0$. Thus $\frac{dt_{L1}^{d*}}{d\beta} < 0$.

Finally, note that when $\beta = 1$, $\hat{r}(1, \oslash_\omega, b) = \hat{r}(1, 0, b)$, so that $U_{L1}(1)$ is the same as that in the CE and we have $t_{L1}^{d*} = t_{L1}^{c*}$. It then follows that for all $\beta < 1$, $t_{L1}^{d*} > t_{L1}^{c*}$. ■

A.4. Proposition 3

Proof. First consider the CE. We have $\alpha_1^{c*} > r + (1-r)p > \frac{c+k}{1+c}$. So the principal will indeed initiate the reform after $m = 1$. By construction, she will persist with it to the end after $n = b$ if and only if $\beta \leq \beta_1$. (Note that t_{L1}^{c*} is independent of β.)

Now consider the DE. For all $\beta > \beta_1$, we have

$$\beta > 1 - \frac{(1-\alpha_1^{c*})c}{\alpha_1^{c*}} > 1 - \frac{(1-\alpha_1^{d*}(.))c}{\alpha_1^{d*}(.)} \tag{15}$$

[Recall that α_1^{d*} depends on β but we denote it by (.) to avoid cluttering of notations.] The last inequality holds because $\alpha_1^{d*}(.) < \alpha_1^{c*}$ for all $\beta < 1$. Therefore (3) holds and the principal cancels the reform after $n = b$. Since the failure cost is always avoided in the DE, the principal starts the reform at $m = 1$ if and only if,

$$\alpha_1^{d*}(.)\beta > k \tag{16}$$

This is always true because by (15),

$$\begin{aligned} \alpha_1^{d*}(.)\beta &> \alpha_1^{d*}(.)(1 - \frac{(1-\alpha_1^{d*}(.))c}{\alpha_1^{d*}(.)}) \\ &= \alpha_1^{d*}(.)(1+c) - c > \frac{c+k}{1+c}(1+c) - c = k \end{aligned} \tag{17}$$

the last inequality follows because $\alpha_1^{d*}(.) > r + (1-r)p > \frac{c+k}{1+c}$. Thus the DE always exists for all $\beta > \beta_1$. Second, it follows by continuity that there exists some $\delta > 0$ sufficiently small such that both (16) and (3) hold for all $\beta \in (\beta_L, \beta_1)$, where $\beta_L = \beta_1 - \delta$. ■

A.5. Proposition 4

Proof. Let $q(.)$ denote the probability that the principal receives $m = 1$ in equilibrium. Note that $q(.)$ depends only on the L-type expert's strategy when his signal is $s = 1$. This is so because an H-type always reports his signals truthfully and so does an L-type when he gets $s = 0$. So let $q(t_{L1}^{j*})$ be the probability that the principal receives $m = 1$ in equilibrium of type j. We then have

$$q(t_{L1}^{j*}) = \frac{1}{2}[r + (1-r)t_{L1}^{j*}] \tag{18}$$

Expected payoffs of the principal in the CE and DE are, respectively,

$$V_C^* = q(t_{L1}^{c*})[\alpha_1^{c*} - (1-\alpha_1^{c*})c - k] \tag{19}$$

$$V_D^*(\beta) = q(t_{L1}^{d*}(\beta))[\alpha_1^{d*}(t_{L1}^{d*}(\beta))\beta - k] \tag{20}$$

As before, we will suppress the argument in $t_{L1}^{d*}(.)$ and $\alpha_1^{d*}(.)$ while remembering that they are functions of β. Substituting the relevant terms, we can verify that

$$\frac{\partial V_D^*}{\partial t_{L1}^{d*}} \geq 0 \text{ iff } p\beta \geq k$$

By construction, we have at β_1

$$V_C^* = q(t_{L1}^{c*})[\alpha_1^{c*} - (1-\alpha_1^{c*})c - k] = q(t_{L1}^{c*})[\alpha_1^{c*}\beta_1 - k] \tag{21}$$

Define $\hat{p}$ such that $\hat{p}\beta_1 = k$. Assumption 3 guarantees that such $\hat{p}$ must be unique and $p\beta_1 < k$ if and only if $p < \hat{p}$. It can also be readily checked that $k < \hat{p} < \frac{c+k}{1+c}$.[20] Now suppose $p < \hat{p}$. Then at β_1,

$$\begin{aligned} V_D^*|_{\beta=\beta_1} &= q(t_{L1}^{d*})[\alpha_1^{d*}(t_{L1}^{d*})\beta_1 - k] \\ &< q(t_{L1}^{c*})[\alpha_1^{c*}(t_{L1}^{c*})\beta_1 - k] = V_C^* \end{aligned}$$

The inequality follows from the fact that $\frac{\partial V_D^*}{\partial t_{L1}^*} < 0$ when $p\beta_1 < k$ and $t_{L1}^{c*} < t_{L1}^{d*}$. The last equality comes from (21). When $\beta = 1$,

$$\begin{aligned} V_D^*|_{\beta=1} &= q(t_{L1}^{d*})[\alpha_1^{d*}(t_{L1}^{d*}) - k] \\ &= q(t_{L1}^{c*})[\alpha_1^{c*} - k] > q(t_{L1}^{c*})[\alpha_1^{c*} - (1-\alpha_1^{c*})c - k] = V_C^* \end{aligned}$$

The second equality follows because at $\beta = 1$, $t_{L1}^{d*} = t_{L1}^{c*}$. To prove part (1) of the proposition, we only need to show that there exists a unique $\beta_M(p)$ such that $V_D^*|_{\beta_M(p)} = V_C^*$. Differentiate V_D^* with respect to β, we have

$$\frac{dV_D^*}{d\beta} = \frac{1}{2}[r + (1-r)pt_{L1}^{d*}] + \frac{1}{2}(1-r)(p\beta - k)\frac{dt_{L1}^{d*}}{d\beta} \tag{22}$$

[20]When $p > \frac{c+k}{1+c}$, we have $\alpha_1^{c*} > \frac{c+k}{1+c}$, which implies that $\beta_1 > \frac{k(1+c)}{k+c}$ and $p\beta_1 > k$.

Since $\frac{dt_{L1}^{d*}}{d\beta} < 0$, $\frac{dW_d}{d\beta} > 0$ as long as $p\beta \leq k$. If $p \leq k$, this obviously is true for all $\beta \leq 1$ and the proof is done. Consider some $p \in (k, \hat{p})$. Let β' be such that $p\beta' = k$. For all $\beta > \beta'$, we have

$$\begin{aligned} V_D^*|_{\beta>\beta'} &= q(t_{L1}^{d*})[\alpha_1^{d*}(t_{L1}^{d*})\beta - k] \\ &> q(t_{L1}^{c*})[\alpha_1^{c*}(t_{L1}^{c*})\beta - k] \\ &> q(t_{L1}^{c*})[\alpha_1^{c*}(t_{L1}^{c*})\beta_1 - k] = V_C^* \end{aligned} \tag{23}$$

The first inequality follows because $p\beta > k$ by construction. The second inequality is true because $\beta > \beta' > \beta_1$. Now since V_D^* is increasing in β for all $\beta \leq \beta'$, it must follow that the $\beta_M(p) < \beta'$ and hence must be unique.

To prove part(2), consider some $p > \hat{p}$. So we have $p\beta_1 > k$ by construction. For all $\beta > \beta_1$, the result now follows by an identical argument as in (23). ■

A.6. Corollary 1

Proof. Part (1). Let $p < \hat{p}$. When $\beta < \beta_1$, following the same arguments as in the last proposition,

$$\begin{aligned} V_D^*|_{\beta<\beta_1} &= q_1(t_{L1}^{d*})[\alpha_1^{d*}\beta - k] \\ &< q_1(t_{L1}^{c*})[\alpha_1^{c*}\beta - k] < q_1(t_{L1}^{c*})[\alpha_1^{c*}\beta_1 - k] = V_C^* \end{aligned}$$

Part (2) Let $\beta_m(p) = \beta_1 - \eta$, where $\eta > 0$. By making η sufficiently small so that $\beta_m(p) \in (\beta_L, \beta_1)$, the existence of the DE is guaranteed. Since $V_D^*|_{\beta_1} > V_C^*$ when $p > \hat{p}$, again, by taking $\eta \to 0$, the result follows by continuity of V_D^* in β. ■

A.7. Proposition 6

Proof. Part (1). This follows directly from proposition 4. Suppose the principal is strictly worse off when an interim news is available. If she delegates the decision rights to another person with $c_j \to 0$, this person will surely ignore any interim news. The CE is then restored.

Part (2). For all $\beta \in (\beta_m(p), \beta_1)$, by choosing some c_j sufficiently large, we have

$$\beta \geq 1 - \frac{(1-\alpha_1^{c*})c_j}{\alpha_1^{c*}} > 1 - \frac{(1-\alpha_1^{d*})c_j}{\alpha_1^{d*}}$$

This implies that (i) the CE is no longer viable; and (ii) by construction, $\alpha_1^{d*}\beta > k$ for all $\beta > \beta_L$ and hence the new decision maker will start the reform and the DE exists. ■

B. Additional Material, Not for Publication

These materials contain mathematical derivation omitted in the main text. They are not intended for publication, but can be made available to readers upon request.

B.1. The Proof for Remark 1

Proof. We first explicitly write the principal's posterior assessment of the expert. (The proof that an H-type expert always tells the truth follows a similar line to Lemma 1 and is hence omitted.)

$$\hat{r}(1,1,\hat{n}) = \frac{r}{r + (1-r)[pt_{L1} + (1-p)t_{L0}]} \geq r \tag{24}$$

$$\hat{r}(0,0,\oslash_n) = \frac{r}{r + (1-r)[p(1-t_{L0}) + (1-p)(1-t_{L1})]} \geq r \tag{25}$$

$$\hat{r}(1,0,\hat{n}) = \hat{r}(0,1,\hat{n}) = 0$$

When $s = 1$

$$U_{L1}(1) = p\hat{r}(1,1,\hat{n}) \text{ and } U_{L1}(0) = (1-p)\hat{r}(0,0,\oslash_n)$$

If $s = 0$,

$$U_{L0}(1) = (1-p)\hat{r}(1,1,\hat{n}) \text{ and } U_{L0}(0) = p\hat{r}(0,0,\oslash_n)$$

To prove that an L-type expert strictly prefers to tell the truth, it suffices to show that $U_{L1}(1) > U_{L1}(0)$ and $U_{L0}(0) > U_{L0}(1)$. Suppose not and, for example, let $U_{L1}(1) \leq U_{L1}(0)$. Since $p > \frac{1}{2}$, we must then have $\hat{r}(1,1,\hat{n}) < \hat{r}(0,0,\oslash_n)$. But then it must follow that $U_{L0}(0) > U_{L0}(1)$ and the L-type expert will strictly prefer reporting $m = 0$ when $s = 0$, i.e., $t_{L0} = 0$. Substituting into (24) and (25), we have

$$\hat{r}(1,1,\hat{n}) = \frac{r}{r + (1-r)pt_{L1}} \geq \hat{r}(0,0,\oslash_n) = \frac{r}{r + (1-r)[p + (1-p)(1-t_{L1})]}$$

for all $t_{L1} \in [0,1]$, which is a contradiction. A similar argument rules out the possibility that $U_{L0}(0) \leq U_{L0}(1)$. ■

B.2. The Case of $k < \frac{1}{2}$

Here we investigate the L-type expert's strategy in the Initiation Equilibrium. When the L-type expert gets $s = 1$, his expected payoffs from reporting $m = 1$ and $m = 0$ are, respectively

$$U_{L1}(1) = p\hat{r}(1,1,g) \text{ and } U_{L1}(0) = (1 - p\beta)\hat{r}(0, \oslash_\omega, b)$$

When $s = 0$, the payoffs are

$$U_{L0}(1) = (1 - p)\hat{r}(1,1,g) \text{ and } U_{L0}(0) = (1 - (1 - p)\beta)\hat{r}(0, \oslash_\omega, b)$$

Standard reasoning shows that $t_{L0}^{I*} = 0$ so that he always truthfully reports $s = 0$ signal. This implies that the principal's posterior belief on the expert is

$$\hat{r}(1,1,g) = \frac{r}{r + (1-r)pt_{L1}^{I*}}$$

and

$$\hat{r}(0, \oslash_\omega, b) = \frac{r}{r + (1-r)[(p(1 - t_{L1}^{I*}) + (1-p))(1-\beta) + ((1-p)(1 - t_{L1}^{I*}) + p)]}$$

The L-type expert uses a strategy $t_{L1}^{I*} \in (0,1)$ in the IE if and only if the following holds.

$$p\hat{r}(1,1,g) = (1 - p\beta)\hat{r}(0, \oslash_\omega, b) \tag{26}$$

The LHS, i.e., the expression for $U_{L1}(1)$ from the above is exactly the same as that in the CE. We can verify that (1) the RHS, i.e., the expression for $U_{L1}(0)$ is strictly smaller than that in the CE, and (2) $\frac{\partial RHS}{\partial \beta} < 0$. Therefore we conclude that (1) $t_{L1}^{I*} \geq t_{L1}^{c*}$ and (2)$\frac{dt_{L1}^{I*}}{d\beta} > 0$. In fact, we can check that (26) holds for $t_{L1}^{I*} < 1$ if and only if

$$(1-r)p(2p-1)\beta \leq r(1 - p - p\beta)$$

Otherwise, we have $t_{L1}^{I*} = 1$ in the IE.

B.3. Unequal Prior

We will illustrate the idea with the CE here. To see the reasoning of the text formally, note that in a candidate truth-telling equilibrium, the posterior reputation for making the correct $m = 1$ recommendation and recommending $m = 0$ are, respectively,

$$\frac{r}{r + (1-r)p} \text{ and } \frac{r}{r + (1-r)[\frac{\pi}{1-\pi}(1-p) + p]}$$

while an incorrect $m = 1$ recommendation results in $\hat{r} = 0$. The L-type expert will deviate and misreport the signal $s = 1$ if and only if

$$\frac{p\pi}{p\pi + (1-p)(1-\pi)} \frac{r}{r + (1-r)p} < \frac{r}{r + (1-r)[\frac{\pi}{1-\pi}(1-p) + p]}$$

The above is equivalent to

$$\left(\frac{\pi}{1-\pi}\right)^2 < 1 + \frac{r}{(1-r)p}$$

The inequality holds for $\pi \leq \frac{1}{2}$. Therefore, the L-type expert will misreport $s = 1$ with positive probability as long as π is not too much larger than $\frac{1}{2}$.

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