# Why Asking Why? Detailed Forecasts and Herd Behavior*

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**Abstract**

In a simple model of career concern for experts, we analyze whether the incentives to release biased forecasts can be reduced by asking the experts to detail/justify their forecasts. It turns out that asking the experts to detail their forecasts has an effect on the incentives to make truthful versus biased forecasts. In particular, we find that, because of career concern, detailed forecasts are less biased than undetailed forecasts as long as it is possible to verify expost whether the details are correct or not. If the details are instead unverifiable, asking detailed forecasts is neutral. We finally find that asking details is harmful and increases the forecasts' bias if some experts are not careerist.

*Keywords*: reputation, cheap talk, forecasting, herd behavior.

*JEL Classification*: D82, D83.

## 1 Introduction

The role of macroeconomic forecasters is not limited to the simple forecasting of GDP. In many cases, they have to justify their forecast and explain why we should believe them. They try to convince us that their predictions make sense. Similarly, financial analysts, sport specialists and political experts, when interviewed by journalists, are typically asked to detail/explain their opinions.

Despite the fact that forecasts are usually detailed, the reasons for having detailed forecasts instead of undetailed forecasts are not obvious. If the role of forecasts is to

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provide information on a variable of interest, for instance GDP, asking details makes sense only if it makes the forecasts more informative. But it is not obvious that detailed forecasts are more informative than undetailed forecasts. If an undetailed forecast already incorporates all the information available to the expert, asking details should indeed not make it more precise.

The aim of the paper is to show that details can improve the precision of forecasts[1]. We provides thus a theoretical justification to the existence of detailed forecasts. The starting point of the paper is to notice that undetailed forecasts do actually not incorporate all the information available to the experts. It is indeed well recognized since Scharfstein and Stein (1990) that, due to reputation concern, experts face strong incentives to release biased forecasts. Since then, the literature on career concern for experts has shown consistently that an expert wishing to appear well informed has a tendency to mimic the behavior of well informed experts. Forecasts are then not necessarily truthful. Because of this strategic behavior, forecasts can be either too far (anti-herd behavior) or to close (herd behavior) from the consensus forecast[2].

We find that the existence of career concern among experts can justify the existence of detailed forecasts. Given that undetailed forecasts are not always truthful, asking details can be useful by inducing the experts to make more truthful forecasts. If the forecasts are detailed, it can be less profitable for an expert to forecast strategically. Therefore, detailed forecasts potentially enhance truthtelling and improve the precision of forecasts.

In order to analyze the role of detailed forecasts, we develop a simple model where experts have to release a forecast on a given variable, for instance GDP. If the experts are asked to release an undetailed forecast, they simply give a number for GDP. If, instead,

[1] Other papers analyze how to organize debates in order to improve forecasts' accuracy. See for instance Glazer and Rubinstein (1998, 2001), Ottaviani and Sorensen (2001) and Klevorick et al. (1984). Ottaviani and Sorensen (2001) analyze who should speak first in a debate. These papers, however, do not focus specifically on the role of forecasts' details.

[2] Additionally to the growing theoretical literature, it is now well established empirically that financial analysts voluntarily bias their predictions. See Zitzewitz (2001), Chen and Jiang (2003) and Bernhardt, Campello and Kutsoati (2004).

they are asked to make a more detailed forecast, then they additionally have to forecast GDP's components such as consumption, investments or exports. Some experts are good and some are bad. They are careerist and maximize their expected reputation. In this kind of economic setting, the standard result of the literature is that a truthtelling equilibrium exists if and only if the private information of the experts is sufficiently precise. Indeed, if the private information is precise, strategic forecasting is too costly in terms of forecasts' precision. Our model is not an exception and obeys that rule. The novelty of the paper is to show that the minimum precision level of the private information required for the existence of a truthtelling equilibrium is different for detailed and undetailed forecasts.

The mechanism of the model is the following. Undetailed forecasts have a property that detailed forecasts do not have: They reveal less precisely the private information. Indeed, experts base their forecasts on a complex multidimensional set of information. GDP forecasters, for instance, use private information on GDP's components such as consumption, investments and exports to form their beliefs. Hence, any forecast on GDP is consistent with multiple combinations of private information on GDP's components. The "non-revealing" property of undetailed forecasts is naturally stronger for average forecasts than for extreme forecasts. In order to get the intuition, imagine that GDP is determined the sum of two dices rolls. An "average" result like 7 can be obtained by several different dices rolls (1+6, 2+5 etc.). An "extreme" result like 2 or 12 is instead consistent with only one roll of dices. This is why, in our model, average undetailed forecasts will be more strongly non-revealing than extreme undetailed forecasts. Non-revealing forecasts have the property of preventing large reputation updating, either upwards or downwards. Indeed, if the private information is not revealed, it is never possible to know for sure that the private information is totally correct or totally false. We find that the optimal choice of the experts is to strategically bias their undetailed forecasts towards the strongly non-revealing forecasts, i.e. average forecasts. By doing so, they escape the possibility of having a dramatically low reputation. They also lose the possibility of having a high reputation but this is less important because it is easier to destroy the reputation than to improve it. Given the strong tendency to release biased non-revealing forecasts, the minimum precision level of the private information required to have a truthtelling equilibrium is very high.

Detailed forecasts, by definition, do not have the non-revealing property. In a truthtelling equilibrium, they perfectly reveal the private information. Average forecasts are thus as revealing as extreme forecasts. As a result, asking details deletes the strong incentive to release the non-revealing average forecasts. This is the main result of the first part of the paper. Details are useful because they destroy the incentive to lie and enhance truthtelling among experts.

In the second part of the paper, we analyze the utility of asking details in a slightly different context. It is still possible to verify expost whether the forecasts made by the experts is correct or not, but we assume that the details are unverifiable. For a GDP forecaster, for instance, it implies that his reputation still depends on his forecast's precision (observable) but not on the individual precision on the forecast's justification. This different context has significant implications: detailed forecasts become useless. Without going into the details, the intuition of this result is the following. Detailed forecasts, because of their unverifiability, do not remove anymore the non-revealing property of average forecasts. Therefore, they do not enhance truthtelling.

We finally find that, if the details are unverifiable, there is a case in which asking details can be harmful instead of useful. This occurs if a given proportion of the experts is not careerist and never releases biased forecasts. In that case, it is possible to release "credible" detailed forecasts, i.e. forecasts with details that are unverifiable but likely to be true. The opportunity to make credible forecasts creates a new incentive to bias forecasts in order to be more "credible". Therefore, when the details are unverifiable, asking details can prevent the existence of a truthtelling equilibrium.

In Section 2, we develop a simple model of strategic forecasting. In Section 3, we propose a criterion to judge whether detailed forecasts are useful or harmful. In Section 4, we solve the model for the case of verifiable details. In Section 5, we solve the model for the case of unverifiable details. Section 6 discusses the robustness of our results and concludes the paper.

# 2 The Model

This is a standard model of career concern for experts, strongly inspired by Scharfstein and Stein (1990), Effinger and Polborn (2001) and Trueman (1994). The reasons for the strong similarity between the economic setting of these three papers and our model are several. First, these models are simple enough to be tractable. They are nevertheless sufficiently complex to analyze interesting issues and they provide powerful and intuitive results. Third, this paper analyzes the very complex issue of detailed forecasts. Having a tractable economic setting is thus particularly important.

## 2.1 Information

We consider a set of experts (forecasters) having to forecast the realization of the variable $e$. This variable $e$ is the sum of its two components, $e_1$ and $e_2$, such that $e = e_1 + e_2$.[3] For instance, if $e$ represents economic growth, $e_1$ and $e_2$ could be respectively the share of growth due to consumption and the share of growth due to investment.

For simplicity, we assume that both $e_1$ and $e_2$ follow a binary distribution. With probability $p_1$, $e_1$=1. With probability $1 - p_1$, $e_1 = 0$. The distribution of $e_2$ is: $\Pr(e_2 = 1) = p_2$, $\Pr(e_2 = 0) = 1 - p_2$. We assume that $p_1$ and $p_2$ are both higher than $\frac{1}{2}$. [4] We assume for simplicity that $e_1$ and $e_2$ are independent variables. The variable $e$ can thus obviously take three values: 0, 1 or 2. More precisely:

$$\Pr(e = 0) = (1 - p_1)(1 - p_2)$$
$$\Pr(e = 1) = p_1(1 - p_2) + p_2(1 - p_1).$$
$$\Pr(e = 2) = p_1 p_2$$

[3] The assumption that $e$ can be expressed as a sum of two components is the main novelty of this model and, we believe, a natural way to analyse the issue of detailed forecasts.

[4] Imposing $p_1$ and $p_2 > \frac{1}{2}$ is just for simplicity and clarity.

The values of $p_1$ and $p_2$ are common knowledge and are called the public information. In addition to this public information, experts receive private information on $e_1$ and $e_2$. The precision of the private information depends on their type. There are two types of experts. Some are good (with probability $\frac{1}{2}$ for simplicity) and some are bad (with probability $\frac{1}{2}$). The type is privately known by the experts.

The private information consists of two private signals, one on $e_1$ and one on $e_2$. Each signal, respectively denoted $s_1$ and $s_2$, can take two values: 0 or 1. We say that the signal $s_1$ is correct if $s_1 = e_1$ and is false if $s_1 \neq e_1$. This also holds for $s_2$. The signals of the good experts are more precise than the signals of the bad experts. The relation between the signals and the variable e is the following.

For good experts:

$\Pr(s_1 = e_1) = \Pr(s_2 = e_2) = g$

$\Pr(s_1 \neq e_1) = \Pr(s_2 \neq e_2) = 1 - g$

For bad experts:

$\Pr(s_1 = e_1) = \Pr(s_2 = e_2) = b$

$\Pr(s_1 \neq e_1) = \Pr(s_2 \neq e_2) = 1 - b$

where $g > \frac{1}{2}$, $b > \frac{1}{2}$ and $g > b$. Good experts receive thus more informative signals than bad experts.

By the Bayesian rules, the expost belief on $e_i$, $i =\{1, 2\}$, for an good expert receiving $s_i = 1$ is[5]:

$\Pr(e_i = 1|s_i = 1) = \frac{p_i g}{p_i g+(1-p_i)(1-g)} > p_i$

If instead $s_i = 0$ :

$\Pr(e_i = 1|s_i = 0) = \frac{p_i(1-g)}{p_i(1-g)+(1-p_i)g} < p_i$

## 2.2 Objective and Timing

Each expert has to release a forecast $f$ on $e$. We assume that the number of possible forecasts is equal to the number of possible events, i.e. 3. If $f = 0$, an expert claims that

[5] Replace g by b for the bad experts.

his private information is $s = s_1 + s_2 = 0$. If $f = 1$, he claims that $s = 1$, and if $f = 2$ he claims that $s = 2$. This forecast $f$ is also called the undetailed forecast of $e$.

We say than an expert releases a detailed forecast if he forecasts $e_1$ and $e_2$ additionally to $e$. The forecasts on the components of $e$ are denoted $f_1$ and $f_2$ and are called the "details". Obviously, the rationality constraint implies that $f = f_1 + f_2$. Indeed, it does not make sense to forecast that the GDP will grow by 1% and forecasting that all GDP's components will grow by 3%.

This is a simple career concern model and we assume that the objective of the experts is to maximize their expected reputation. They want to be perceived as a good experts by the market.[6] Given that they are only two types in this model, the reputation is simply the market belief on the probability the expert is good, denoted $\Pr(good)$, given the forecast(s) he has released and the realized event(s).

The timing is the following:

1. The experts receive private signals $s_1$ and $s_2$.

2. They release a forecast on $e$ and also on $e_1$ and $e_2$ if they are asked to.

3. The events $e_1$ and $e_2$, and therefore $e$ are realized. The realization of $e$ is always observed. In Section 4 we assume the realizations of $e_1$ and $e_2$ are observed while in Section 5 we instead assume that $e_1$ and $e_2$ are not observed individually.

4. After observing the forecast(s) and the realized event(s), the market updates the experts' reputation $\Pr(good)$.

# 3 Truthful vs. Biased Forecasts

We know from the seminal paper of Scharfstein and Stein (1990) that, due to career concern, experts have incentives to release biased forecasts. If these incentives are strong

[6] The market observes their forecasts and is fully aware of their reputation. In a flexible labor market, having a higher reputation increases their wage. Moreover, and given that the values of $b$ and $g$ are common knowledge, it would be useless to introduce a relative performance evaluation like in Zwiebel (1995).

enough, they will deviate from truthtelling and make forecasts that are inconsistent with their private information. This model is not an exception and truthtelling is therefore not an obvious outcome. It may indeed be optimal for an expert to hide his private signal if the revelation of his signal is likely to hurt his reputation. This behavior typically occurs when a very weak private signal contradicts a very solid public information. In that case, the private signal is likely to be false and it is safer for the reputation to pretend that the private signal does not contradict the public information. This is one of the reasons why a truthtelling equilibrium does not always exist. Imagine for instance that the consensus is that the GDP will grow by 4% this year. Then an expert receiving a 0% signal will not trust it and may indeed be tempted to hide it by herding the consensus forecast. The incentive to release biased forecasts is a typical results in career concern for experts literature.

**Definition 1:** *A forecast $f$ on $e$ is truthful if it is consistent with the private information of the expert.*

This is a simple and natural definition for truthtelling. In our model, for instance, an expert receiving the private information $s = 1$ makes a truthful forecast if and only if $f = 1$. Remark that a truthful forecast does not request the details to be truthful. For instance if $s_1 = 1$ and $s_2 = 0$, the detailed $f = 1$ forecast is truthful even if the details are $f_1 = 0$ and $f_2 = 1$ instead of $f_1 = 0$ and $f_2 = 1$. What matters for a forecast to be truthful is thus only that the sum $f = f_1 + f_2$ is truthful.

Truthful forecasts are desirable. Indeed, they perfectly reveal the private information $s$ and they are therefore quite informative. Biased forecasts can instead not be trusted. The first best is then the truthtelling equilibrium, an equilibrium such that no expert releases a biased forecast on $e$. In the rest of the paper, we analyze whether asking the experts to detail their forecasts affects the existence of a truthtelling equilibrium. This is a simple way to analyze whether detailed forecasts are useful or not. It will turn out that asking details sometimes increases sometimes decreases the incentives to lie.

**Definition 2:** *We consider that:* (i) *Asking details is useful if it increases the size of the parameters' space such that a truthtelling equilibrium exists. (ii) Asking details is harmful if it decreases the size of the parameters' space such that a truthtelling equilibrium exists. (iii) Asking details is neutral if it does not affect the size of the parameters' space such that a truthtelling equilibrium exists.*

This criterium is simple and intuitive. Other criteria could be used to assess the utility of asking detailed forecasts. For instance, is the non existence of a truthtelling equilibrium worse for detailed or for undetailed forecasts? Answering this question would be interesting but very complex. Our criterion provides an intuitive analysis of the role of detailed forecasts and remains tractable.

# 4 Verifiable Details

In this section we analyze how detailed forecasts affect the existence of a truthtelling equilibrium when $e_1$ and $e_2$ are observable. We say that the details $f_1$ and $f_2$ are verifiable if $e_1$ and $e_2$ are observable. Imagine for instance an expert forecasting ($f$) that GDP growth ($e$) will be lower than expected due to the weakening of consumption ($e_1$). The data on consumption are easily available, and $e_1$ is thus observable. The forecast ($f_1$) that consumption will be weak is thus verifiable expost. Therefore the reputation of the expert will depend on whether $f_1$ is correct or not. Assuming that all events are perfectly verifiable is standard in the literature. It is nevertheless an extreme assumption that we make to have simple and intuitive results.

We first analyze under which conditions there exists a truthtelling equilibrium for the undetailed forecasts. Then we compare these conditions with those required for the existence of a truthful detailed forecasts equilibrium and we conclude that details are useful in the sense of Definition 2.

### 4.1 Undetailed Forecasts

*1. Equilibrium*

When the forecasts are undetailed, the experts only have to forecast $e$ (i.e. the sum $e_1+e_2$) but not $e_1$ and $e_2$ individually. This is for instance the case if an expert forecasts GDP ($e$) but not its components. Three undetailed forecasts are possible: $f=0$, $f=1$, $f=2$. Remember that if $f=0$, the expert claims that $s=s_1+s_2=0$. If $f=1$, the expert claims that $s=s_1+s_2=1$. If $f=2$, the expert claims that $s=s_1+s_2=2$. Let us define the utility $U(f)$ as the expected reputation that an expert gets by releasing the forecast $f$ :

$$U(f)=\Pr(e=0|s)\Pr(good|f,e=0)+\Pr(e=1|s)\Pr(good|f,e=1)+\Pr(e=2|s)\Pr(good|f,e=2) \quad (1)$$

where $\Pr(e=0|s)$ is simply the probability of $e=0$ given the private signal $s$. The expression $\Pr(good|f,e=0)$ is the reputation of the expert given his forecast $f$ and the realized event $e=0$. Idem for $e=1$ and $e=2$.

There exists a truthtelling equilibrium if, for all the experts, the utility of releasing the forecast $f=s$ is higher then the utility of releasing any other forecast. There exists thus a truthtelling equilibrium if, when the market believes that all forecasts are truthful:

$$U(f=s)\geq U(f\neq s)$$

for all $s$ and all types. If there exists a $s$ such that this condition does not hold, then there exists no truthtelling equilibrium.

**Proposition 1** *: **Conditions for the existence of a truthtelling undetailed forecasts equilibrium** (i) There exists no truthtelling equilibrium if $b<p_1$ and/or $b<p_2$. (ii) If $b>p_1$ and $b>p_2$, a truthtelling equilibrium does not always exist.*

**Proof.** See Appendix A ■

This proposition shows that a necessary condition for the existence of a truthtelling equilibrium is that the experts are smart enough ($b$ sufficiently large relative to $p_1$ and

$p_2$). This is not a surprising result. If the private information $s$ is not sufficiently precise, then the bad experts do not trust it and, as we explained in Section 3, they have an incentive to lie if $s$ contradicts the public information[7].

*2. The non-revelation property of* $f = 1$

It turns out that the experts with highest incentive to lie are those with $s = 0$ and then those with $s = 2$. They indeed have a strong incentive to forecast $f = 1$ instead of $f = 0$ or $f = 2$. This suggests that the $f = 1$ forecast is a very attractive forecast. In order to understand why $f = 1$ is attractive, it is crucial to figure out that $f = 1$ has a special property that $f = 0$ and $f = 2$ do not have: It is a non-revealing forecast, meaning that it does not reveal the private information of the experts. Indeed, $f = 1$ tells that $s_1 + s_2 = 1$ but does not tell whether it is $s_1$ or $s_2$ which is equal to 1. This "non-revealing" property of $f = 1$ is obviously specific to $f = 1$. Indeed, $f = 0$ or 2 fully reveal that both private signals are respectively 0 or 1.

This non-revealing property of $f = 1$ turns out to be a very useful and it exploited by the experts. Indeed, if $e = 1$ and $f = 1$, the non-revealing property implies that it is not possible to know whether the forecast $f = 1$ comes from two correct signals or from two incorrect signals. For instance, if $e_1 = 0$ and $e_2 = 1$, the $f = 1$ forecast could come from two correct signals $s_1 = 0$ and $s_2 = 1$ or from two false signals $s_1 = 1$ and $s_2 = 0$. This has the important implication that the reputation of an expert forecasting $f = 1$ cannot fall or increase sharply. Indeed, for the reputation to move sharply, the market has to know that both signals are either correct or false. This is never the case for the non-revealing $f = 1$. In other words, $f = 1$ is an insurance that the reputation will not become extremely high or low. This would obviously be very useful if the experts were risk averse. But we have assumed that they maximize the expected reputation. So why is this "insurance" still useful? Simply because revealing two false signals is more informative on the type than two correct signals. Indeed, $g$ and $b$ being both higher than $\frac{1}{2}$, the reputation of an expert revealing two correct signals cannot be higher

[7] Note that the constraint is on $b$ and not on $g$. This is normal given that $g > b$, and that therefore good experts trust more their private information then bad experts.

than $\frac{g^2}{g^2+b^2} = \frac{1}{1+\frac{1}{4}} = 0.8$. The reputation in case of two incorrect signals can instead be extremely low. Indeed, $\frac{(1-g)^2}{(1-g)^2+(1-b)^2}$ can even go to 0. A failure is thus always more informative on the type than a success. As a result, it is more important to prevent a failure than to ensure a successful forecast. This is why the non-revealing property of $f = 1$ is a very interesting property. The forecasts will thus typically be biased towards $f = 1$.

### 4.2 Detailed Forecasts

When the forecasts are detailed, the experts have to forecast the two components of the variable $e$: $e_1$ and $e_2$. At first sight, one could think that it does not make any difference with the undetailed forecasts because $e = e_1 + e_2$. This would be true if experts were systematically making truthful forecasts, but unfortunately they do not. We know that experts face strong incentives to release biased forecasts and it turns out that the strength of these incentives is not identical for detailed and undetailed forecasts.

Given that the experts release now two forecasts $f_1$ and $f_2$ instead of only $f$, there exists a truthtelling equilibrium on $f$ if and only if there exists a truthtelling equilibrium for both $f_1$ and $f_2$. Indeed, if for instance there exists a truthtelling equilibrium for $f_1$ but not for $f_2$, then $f = f_1+f_2$ will not be always truthful. For any event $e_i$, there exists a truthtelling equilibrium if, for all the experts, the utility of releasing the forecast $f_i = s_i$ is higher then the utility of releasing the forecast $f_i \neq s_i$. This simple condition is due to the fact the both $e_1$ and $e_2$ follow a binary distribution. There exists thus a truthtelling equilibrium for $e_i$ if:

$$U(f_i = s_i) \geq U(f_i \neq s_i)$$

for all $s_i$ and all types.[8]

If there exists a $s$ such that this condition does not hold,then there exists no truthtelling equilibrium for $e_i$. Proposition 2 derives the simple conditions for having a truthtelling equilibrium for a detailed forecast.

[8] $U(f_i = s_i) = \Pr(e_i = 0|s_i) \Pr(good|f_i, e_i = 0) + \Pr(e_i = 1|s_i) \Pr(good|f_i, e_i = 1)$

**Proposition 2** *: **Conditions for the existence of a truthtelling detailed forecast equilibrium.** (i) A truthtelling equilibrium on $f$ exists if both $b > p_1$ and $b > p_2$. (ii) If $b < p_1$ and/or $b < p_2$, there exists no truthtelling equilibrium.*

**Proof.** See Appendix A. ■

Proposition 2 states that if experts are smart enough ($b > p_1$ and $b > p_2$), then truthtelling occurs. The intuition is simply that if the private information $s_i$ is more precise than the public information, the expost belief on $e_i$ is closer to the private information than to the public information. In that case, even a $s_i$ contradicting the public information is more likely to be correct than false. If instead the private information is less precise, $b < p_i$, then at least the bad experts trust more the public information than their signals. Bad experts have then an incentive to hide a private signal contradicting the public information. They will therefore release the forecast $f_i \neq s_i$ instead of $f_i = s_i$. This is a standard result of the theoretical literature, especially in Trueman (1994) but also in Ottaviani and Sorensen (2005) or Effinger and Polborn (2001) for instance.

A direct implication of Propositions 1 and 2 is that details are no neutral. Indeed, the necessary conditions for the existence of a truthtelling equilibrium are not the same in these two propositions. In order to understand why details are relevant, it is crucial to stress the fundamental difference between detailed and undetailed forecasts. The difference comes naturally from the $f = 1$ forecast. We have shown in Section 4.1 that the $f = 1$ undetailed forecast has the special property of non-revealing the private information. This non-revealing property of $f = 1$ obviously disappears with the detailed forecasts, which by definition reveal the private signals (if all forecasts are truthful). This difference has huge implications. In particular the reputation of an expert making the $f = 1$ forecast depends on whether details are asked or not[9]. This can be shown easily:

If the market believes that all forecasts are truthful, then the utility (reputation) of an expert making a detailed $f = 1$ forecast is:

1. $U(f = 1) = \frac{g(1-g)}{g(1-g)+b(1-b)}$ if $e = 0$ or $e = 2$.

[9] Note that if $f = 2$ or $f = 0$, details do not change anything because these forecasts already reveal that both signals are respectively 1 or 0.

2. $U(f=1)=\frac{g^2}{g^2+b^2}$ if $e=1$ and the details $f_1$ and $f_2$ are correct.

3. $U(f=1)=\frac{(1-g)^2}{(1-g)^2+(1-b)^2}$ if $e=1$ and the details $f_1$ and $f_2$ are incorrect.

If the market believes that all forecasts are truthful, then the reputation of an expert making an undetailed $f=1$ forecast is instead:

1. $U(f=1)=\frac{g(1-g)}{g(1-g)+b(1-b)}$ if $e=0$ or $e=2$.

2. $U(f=1)=\frac{(1-g)^2+g^2}{(1-g)^2+g^2+(1-b)^2+b^2}$ if e=1.

The value of $U(f=1|e=1)$ is thus clearly what drives the difference between detailed and undetailed forecasts. The expected reputation that an expert can get by forecasting $f=1$ depends thus on whether details are asked or not. This, in turns, affects the incentive to forecast $f=1$, whether this forecast is truthful or not.

This difference between detailed and undetailed forecasts makes sense in the real world. Consider for instance GDP forecasts. If the forecast is undetailed, a moderate forecast could be due to moderate signals on all GDP components or it could instead be the result of optimistic information on consumption and pessimistic signals on investment. A moderate forecast ($f=1$ in the model) does not reveal perfectly the private information. If the forecaster is asked to detail his forecast, he will also forecast consumption and investment and the private information is revealed.

### 4.3 Should Forecasts Be Detailed?

We have shown that details are not neutral regarding the existence of a truthtelling equilibrium. The question is then whether they should be asked or not. Thanks to Propositions 1 and 2, it is immediate that asking details increases the probability of having a truthtelling equilibrium. This is what Proposition 3 states.

**Proposition 3** *Asking details increases the parameters' space such that a truthtelling equilibrium exists.*

**Proof.** See Appendix A. ■

This proposition is the main result of this Section. If $b > p_1$ and $b > p_2$, we know that detailed forecasts are always truthful. If the forecast is not detailed, however, Proposition 2 tells us that a truthtelling equilibrium does not necessarily exists if $b > p_1$ and $b > p_2$. Details are thus useful and unambiguously enhance truthtelling.

In order to understand why details are useful, remember that undetailed forecasts are often biased towards the non-revealing $f = 1$. It is now easy to figure out why asking details is useful. Indeed, the main characteristic of detailed forecasts is that they do not have this non-revealing property. Naturally, this decreases the attractivity of forecasting $f = 1$, which in turns increases the incentive to make a truthful forecasts if $s = 0$ or $s = 2$. The intuition is thus that, detailed forecasts, by removing the non-revealing property of $f = 1$, decrease the incentive to make a biased $f = 1$ forecast. Truthtelling is thus more likely to occur when forecasts are detailed[10].

If $b < p_1$ and/or $b < p_2$, asking details does not affect the existence of a truthtelling equilibrium. The reason is simply that in that case, it is impossible to have a truthtelling equilibrium even if the forecast is detailed. This however does not mean that details are totally useless, but at least they do not affect the existence of a truthtelling equilibrium.

### 4.4 A Numerical Example

Let us build at a simple numerical example to illustrate the results of Propositions 1-3. We consider the following parameters' values:

$p_1 = p_2 = 0.55$

$b = 0.6$

$g = 0.8$

[10] In appendix A, we show that Proposition 3 is also valid if $p_1$ and/or $p_2 < \frac{1}{2}$.

We set $p_1 = p_2$ for simplicity and to make the intuition simpler. We set $b > p_1 = p_2$ in order to make the problem interesting (asking details would otherwise be neutral). Obviously we set $g > b$. With this choices for the parameters, the role of detailed forecasts will appear clearly.

#### 4.4.1 Detailed Forecasts

It is not difficult to show that there exists a truthtelling equilibrium. Indeed, Proposition 2 states that $b > p_1 = p_2$ is a sufficient condition for the existence of a truthtelling equilibrium. Here is a table showing the reputation that an expert receives for a given forecast $f$ and a given event $e$. These numbers assume that the market believes that all agents release truthful forecasts.

| | e=0 | e=1 | e=2 |
|---|---|---|---|
| $f$=0 | 0.64 | 0.4 | 0.2 |
| $f$=1 | 0.4 | 0.64 or 0.2 | 0.4 |
| $f$=2 | 0.2 | 0.4 | 0.64 |

For instance, if $f = 0$ and $e = 0$, the expert's reputation is 0.64. Indeed, he has received two correct signals $s_1$ and $s_2$. Therefore his reputation is $\frac{g^2}{g^2+b^2} = 0.64$. If instead $f = 0$ and $e = 2$, the expert has received two incorrect signals and his reputation is simply $\frac{(1-g)^2}{(1-g)^2+(1-b)^2} = 0.2$. And so on. If $f = 1$ and $e = 1$ the reputation is either 0.64 or 0.2 depending on whether the details are correct or not. The experts who have the highest incentive to deviate from the equilibrium are obviously the bad experts with signals contradicting the private information ($s = 0$) because they trust the least their private signals. We check thus first whether these experts have an incentive to deviate from truthtelling.

The expected reputation of releasing a truthful forecast $f = 0$ for a bad expert with $s = 0$ is:

$U(f = 0|s = 0) = \Pr(e = 0|s)\Pr(good|f = 0, e = 0) + \Pr(e = 1|s)\Pr(good|f = 0, e = 1) + \Pr(e = 2|s)\Pr(good|f = 0, e = 2) = 0.432$

The expected reputation of releasing a biased forecast $f = 1$ for a bad expert with $s = 0$ is:

$U(f = 1|s = 0) = \Pr(e = 0|s)\Pr(good|f = 1, e = 0) + \Pr(e = 1|s)\Pr(good|f = 1, e = 1) + \Pr(e = 2|s)\Pr(good|f = 1, e = 2) = 0.409$

Finally, $U(f = 2|s = 0) = 0.388$. Therefore, bad experts with private information contradicting the public information do not deviate from truthtelling. This is also easily verified if $s = 1$ or $s = 2$. There exists thus a truthtelling equilibrium.

#### 4.4.2 Undetailed Forecasts

In this numerical example, details are useful. Indeed, it is easy to show that there exists no truthtelling undetailed forecasts equilibrium. We have argued in Section 4.1 that forecasts are often biased towards $f = 1$. In this example, this will also be the case. In order to show that truthtelling is not an equilibrium, it is sufficient to show that one expert deviates from it. Let us again consider a bad expert with $s = s_1 + s_2 = 0$. We have shown that this expert does not deviate from truthtelling when the forecast is detailed. When the forecast is not detailed, however, it is not true anymore.

The expected reputation of releasing a truthful forecast $f = 0$ for a bad expert with $s = 0$ is:

$U(f = 0|s = 0) = \Pr(e = 0|s)\Pr(good|f = 0, e = 0) + \Pr(e = 1|s)\Pr(good|f = 0, e = 1) + \Pr(e = 2|s)\Pr(good|f = 0, e = 2) = 0.432$

The expected reputation of releasing a biased forecast $f = 1$ for a bad expert with $s = 0$ is:

$U(f = 1|s = 0) = \Pr(e = 0|s)\Pr(good|f = 1, e = 0) + \Pr(e = 1|s)\Pr(good|f = 1, e = 1) + \Pr(e = 2|s)\Pr(good|f = 1, e = 2) = 0.482$

Therefore, $U(f = 1|s = 0) > U(f = 0|s = 0)$ and a truthtelling equilibrium is not possible. In order to understand why telling $f = 1$ is the optimal forecast even if $s = 0$, here the reputation matrix for the undetailed forecasts:

| | e=0 | e=1 | e=2 |
|---|---|---|---|
| $f$=0 | 0.64 | 0.4 | 0.2 |
| $f$=1 | 0.4 | 0.566 | 0.4 |
| $f$=2 | 0.2 | 0.4 | 0.64 |

This table clearly shows the difference between detailed and undetailed forecasts. The undetailed $f = 1$ forecast is more attractive than the $f = 1$ detailed forecast because the very low 0.2 reputation does not belong to it. The reason why there is no 0.2 in the $f = 1$ row is that the $f = 1$ forecast is non-revealing, which prevents the experts from getting a very low reputation.

This numerical example shows how the non-revealing property of $f = 1$ prevents the existence of an undetailed forecasts truthtelling equilibrium. Asking details removes the non-revealing property of $f = 1$ and increases the incentive to release truthful forecasts.

## 5 Unverifiable Details

We have assumed so far that the reputation is updated after $e$, $e_1$ and $e_2$ are observed. In the real world, however, it could very well be that the components of $e$ are not observed, or at least less perfectly observed than $e$. In that case, the details $f_1$ and $f_2$ can not be verified. Here are two motivating examples.

**Example 1: GDP forecasters.**

Imagine a macroeconomic expert forecasting GDP in the US. He forecasts a weak growth (2%) and gives two reasons. First, rising oil prices will affect consumers and businesses sufficiently to reduce growth sharply. Second, the rising interest rates will slow the economy down. Suppose that the 2% forecast turns out to be correct. This successful forecast of the event $e$ will definitely improve the expert's reputation. But it is not clear whether the reasons he gave (the details) are correct or not. For instance, it is very difficult to estimate precisely the impact of oil prices on the economy. The impact of oil prices ($e_1$) is therefore less perfectly observed than the value of GDP ($e$).

**Example 2: Political experts.**

Imagine a political expert having to predict the result of a referendum on the EU constitution. He predicts ($f$) the 'no' to win and gives two reasons for it. First, people will vote 'no' to punish the government ($f_1$). Second, it is easier to campaign for the 'no' than for the 'yes' ($f_2$). Imagine that the 'no' wins (realized event $e$). The expert is then "rewarded" for the correct forecast and his reputation will improve. The determinants of the 'no' victory are however imperfectly known. The details $f_1$ and $f_2$ could be correct, but it is not sure at 100%. In this example, the details given by the expert are not perfectly observable.

These two examples suggest that in the real world, the components of $e$ are not necessarily perfectly observed. In this section we analyze this issue by assuming that $e_1$ and $e_2$ are not observed, only the sum $e = e_1+e_2$ is observed. This assumption is the opposite extreme of the perfect observability assumption. Considering extreme assumptions is a deliberate choice that will stress clearly the role of details' verifiability.

**Assumption :** *The realized values of $e_1$ and $e_2$ are not observed individually before the reputation is updated.*

This issue of details verifiability will turn out to be crucial. Indeed, with this assumption, details become useless or even harmful. An obvious reason why the details' verifiability matters is the following. When details cannot be verified, experts' reputations do not depend on whether the details $f_1$ and $f_2$ are correct or not. This difference with Section 4 has the immediate consequence that the experts do not care about the precision of the details they give. This naturally affects their behavior.

## 5.1 Undetailed vs. Detailed Forecasts

When the forecasts are undetailed, the details' verifiability issue is totally irrelevant and has not impact on experts' behavior. If the experts are not asked to forecast $e_1$ and $e_2$, the non observability of $e_1$ and $e_2$ does not affect the experts' reputation. It has therefore no impact on their behavior[11]. The conditions for the existence of a truthtelling equilibrium

[11] See proof in Appendix B.

are the same than in Section 4 and Proposition 1 holds.

The issue of details' verifiability becomes important when we consider detailed forecasts. Indeed, we find that the existence of a truthtelling equilibrium for detailed forecasts is affected by the non verifiability of the details in such a way that asking detailed forecasts becomes useless in the sense of Definition 2. This is what Proposition 4 states.

**Proposition 4** *: If the details are not verifiable, the conditions for the existence of a truthtelling equilibrium are identical for detailed and undetailed forecasts. Asking details has thus no effect on the existence of a truthtelling equilibrium.*

**Proof.** See appendix B. ■

This proposition is significantly different from the results of Section 4. In order to understand why unverifiable details are useless, it is crucial to figure out that the "revelation effect" of detailed forecasts is now irrelevant. In Section 4, asking details was useful because it removed the non-revealing property of the $f = 1$ forecast. In this section, the revelation effect of detailed forecasts is totally useless. Indeed, detailed forecasts still reveal the private signals of the experts but this information cannot be exploited by the market: The unverifiability of details prevents the market from updating sharply the reputation of the experts forecasting $f = 1$. The $f = 1$ forecast stays thus attractive despite the details. Detailed forecasts are thus as biased towards $f = 1$ as undetailed forecasts. This is why asking details is not useful when $e_1$ and $e_2$ are not observable.

### 5.2 Honest Experts and the Credible Details

In this subsection we show that, in special circumstances, asking unverifiable details can even be harmful and decrease the probability of the existence of a truthtelling equilibrium. This is for instance the case when some experts are honest and never lie.

**Assumption:** *A proportion $\lambda < 1$ of the experts are "honest". They are not careerist and are only concerned by the precision of their forecasts. Their forecasts on $e$, $e_1$ and $e_2$ are always truthful.*

This assumption may seem irrelevant as first sight, but it turns out that it has important implications on our results. Proposition 5 shows that in that case, details are harmful in the sense of Definition 2.

**Proposition 5** *: If a proportion $\lambda$ of the experts are honest, asking detailed forecasts can be harmful and can prevent the existence of a truthtelling equilibrium.*

**Proof.** See appendix B. ■

Proposition 5 is a surprising result. The reason why details can be harmful is that, in equilibrium, experts now have the possibility of giving "credible" detailed forecasts. Credible details are details that are likely to be true but that are unverifiable. Here is a simple example to illustrate the meaning of credible details. Imagine two experts A and B having forecasted successfully an increase in oil prices. Expert A tells that is due to a strong demand, while expert B gives an explanation that has nothing to do with the oil market. Even if the reasons for this increase are not known, the expert A's explanation is obviously more "credible" than the one of expert B. Expert B is not credible despite the fact that his explanation (i.e. details) is not verifiable.

In this model, the possibility of having credible details exists when $e = 1$ and $f = 1$.[12] In that case, all the combinations of $f_1$ and $f_2$ have not the same probability of being correct. It is easy to show that as long as $p_1 > p_2$, it has to be that $\Pr(s_1 = 1) > \Pr(s_2 = 1)$. Thus, even if the details cannot be verified, some details are more likely to be correct than others. In this model, the details $f_1 = 1$ and $f_2 = 0$ are thus more credible than the details $f_1 = 0$ and $f_2 = 1$ as long as $p_1 > p_2$ and vice-versa.

The immediate implication of the existence of credible details is that an expert can expect a higher reputation by telling credible details then by telling non credible details.

[12] If $e \neq 1$ and/or $f \neq 1$, there is no possiblity of having details more credible than others. Indeed, $f = 0$ or $f = 2$ perfectly reveal the private information. This perfect revelation implies that it is not possible to pretend having received private signals that have not been received. If $f = 1$ and either $e = 0$ or $e = 2$, there is always one signal which is correct and one which is not. Therefore, the only situation in which "credible" details applies is when both $f = 1$ and $e = 1$.

Giving credible details is even better than giving no details. Indeed, $p_1 > p_2$ implies that[13]:

$$\Pr(good|e = 1, f_1 = 1, f_2 = 0) > \Pr(good|e = 1, f = 1) > \Pr(good|e = 1, f_1 = 0, f_2 = 1) \quad (2)$$

Asking details gives thus the opportunity to the experts to give credible details in order to improve their reputation.

Proposition 5 states that the possibility of giving credible details can make detailed forecasts less truthful than undetailed forecasts. Why it is so? Asking details gives the possibility to the experts forecasting $f = 1$ to give details that, if $e = 1$, will look credible. This increases the expected reputation of the experts making the $f = 1$ detailed forecast by making them more "credible". It increases thus the attractivity of $f = 1$ as well as the incentive to release a biased forecast $f = 1$. The credible details effect incites thus the experts to bias the forecasts towards $f = 1$. This is why details can be harmful.

Note that this credible details effect exists only in equilibrium if some experts are honest ($\lambda > 0$). Without the existence of honest experts, all the experts forecasting $f = 1$ would give credible details whatever their private signals. In that case, the rational market cannot infer any information from these details. Giving credible details when $\lambda = 0$ is then equivalent to giving no details and the attractivity of $f = 1$ comes back to its original level. This is why this effect does not appear in Section 5.1. If some experts are honest, however, there is always a possibility that credible details come from an honest expert. In that case, even if all the careerist experts lie, there is still a value to releasing credible details.

## 5.3 A Numerical Example

As in Section 4, we present a simple numerical example to illustrate the results of Propositions 4-5. We consider the following parameters' value:

[13] See the proof of Proposition 5.

$p_1 = 0.55$

$p_2 = 0.8$

$b = 0.85$

$g = 0.95$

$\lambda = \frac{1}{2}$

We set $p_1 \neq p_2$ because otherwise the effect of details is neutral, as stated in Proposition 5. Indeed, if $p_1 \neq p_2$, all the details have the same level of credibility. We set $b$ and $g$ such that this numerical example is interesting. In this example, half of the experts are not careerist ($\lambda = \frac{1}{2}$). With these values, there exists a truthtelling equilibrium is the forecasts are not detailed, but there exists no detailed forecasts truthtelling equilibrium. The possibility to give credible details will have a huge importance in this example.

### 5.3.1 Undetailed Forecasts

There exists a truthtelling undetailed forecasts equilibrium. We have chosen the parameters' value such that the attractivity of $f = 1$ is not too high. In particular, by choosing a high value for $b$, 0.85, the bad experts trust sufficiently their private information and do not want to lie towards $f = 1$.

Here is the reputation matrix for a given $e$ and forecast $f$ :

| | e=0 | e=1 | e=2 |
|---|---|---|---|
| $f$=0 | 0.555 | 0.27 | 0.1 |
| $f$=1 | 0.27 | 0.548 | 0.27 |
| $f$=2 | 0.1 | 0.27 | 0.555 |

For instance, if $f = 1$ and $e = 1$, the expert has received either two correct signals or two false signals. Therefore his reputation is $\frac{g^2+(1-g)^2}{g^2+(1-g)^2+b^2+(1-b)^2} = 0.548$.

We first show that the bad experts receiving $s_1 = s_2 = 0$ do not deviate from a truthtelling equilibrium.

The expected reputation of releasing a truthful forecast $f = 0$ for a bad expert with $s = 0$ is:

$U(f=0|s=0) = \Pr(e=0|s)\Pr(good|f=0,e=0) + \Pr(e=1|s)\Pr(good|f=0,e=1) + \Pr(e=2|s)\Pr(good|f=0,e=2) = 0.395$

The expected reputation of releasing a biased forecast $f = 1$ for a bad expert with $s = 0$ is:

$U(f=1|s=0) = \Pr(e=0|s)\Pr(good|f=1,e=0) + \Pr(e=1|s)\Pr(good|f=1,e=1) + \Pr(e=2|s)\Pr(good|f=1,e=2) = 0.394$

Note that $U(f=0|s=0) > U(f=1|s=0)$. Therefore these experts do not have an incentive to lie. It is easy to show that the other experts also release truthful forecasts[14]. Therefore and a truthtelling equilibrium exists. This is due to the high value of $b$ that we have chosen. If $b$ was slightly lower it would not be the case.

### 5.3.2 Detailed Forecasts

It is easy to show that, in this example, there exists no truthtelling equilibrium if the details are asked. We will show that a bad expert with $s_1 = s_2 = 0$ deviates from a truthtelling equilibrium. Here is the reputation matrix for detailed forecasts if the market believes that all experts release truthful forecasts $f$ and give credible details:

| | e=0 | e=1 | e=2 |
|---|---|---|---|
| $f$=0 | 0.555 | 0.27 | 0.1 |
| $f$=1 | 0.27 | 0.55 | 0.27 |
| $f$=2 | 0.1 | 0.27 | 0.555 |

Note that this matrix is not identical to the reputation matrix of undetailed forecasts. The reputation if $f = 1$ and $e = 1$ is indeed 0.55 instead of 0.548.[15] This difference comes from the credible details effect. If $f = 1$, the experts have the possibility to give credible details. This increases the reputation if $e = 1$, which explains why the reputation goes up from 0.548 to 0.55.

[14] $U(f=1|s=1) - U(f=2|s=1) = 0.177$ or 0.066 depending on the values of $s_1$ and $s_2$. Obviously then, $U(f=1|s=1) > U(f=0|s=1)$ and $U(f=0|s=0) - U(f=2|s=0)$.

[15] See proof in Appendix B.

Let us again consider a bad expert with $s_1 = s_2 = 0$. As for undetailed forecasts, if he tells the truth his expected reputation is:

$U(f = 0|s = 0) = 0.395$

We can see on the $f = 0$ row that the reputation is identical for detailed and undetailed forecasts. What changes, however, is the reputation if he forecasts $f = 1$. Indeed, he has now the possibility of giving credible details. The expected reputation releasing the biased forecast $f = 1$ is thus:

$U(f = 1|s = 0) = \Pr(e = 0|s)\Pr(good|f = 1, e = 0) + \Pr(e = 1|s)\Pr(good|f = 1, e = 1) + \Pr(e = 2|s)\Pr(good|f = 1, e = 2) = 0.396$

Contrary to undetailed forecast, the utility of forecasting $f = 1$ is now higher than the utility of telling the truth: $0.396 > 0.395$. Truthtelling can thus not be an equilibrium anymore. This example shows clearly that, because of the credible details effect, asking details can be harmful.

## 6 Concluding Remarks

*About the attractivity of non-revealing forecasts*

One of the key property of this model is that non-revealing forecasts are more attractive than revealing forecasts. This is what drives the result of Proposition 3: Detailed forecasts are useful if the details are observable. The attractivity of $f = 1$ is due to the fact that an unsuccessful forecast is always more informative about the type than a successful forecast. Indeed, $\frac{g}{g+b}$ is closer to $\frac{1}{2}$ than $\frac{1-g}{1-g+1-b}$. One could however argue that in reality, forecasting successfully some events can be very informative on the type. For instance, forecasting a recession is not an easy task[16]. The inability to forecast a recession is instead much more common. In this case it is $\frac{g}{g+b}$ that should be very informative and not $\frac{1-g}{1-g+1-b}$. Experts would then be attracted by revealing forecasts. So, what would happen in a world where experts are more attracted by revealing forecasts than by non-revealing forecasts? Would it still be optimal to ask details? Probably yes.

[16] See for instance Loungani (2000) and Zarnowitz (1986).

Indeed, because of the incentive to make revealing forecasts, undetailed forecasts would be biased towards $f = 0$ and $f = 2$ instead of $f = 1$. Asking details, by destroying the non-revealing property of $f = 1$, would also remove the incentive to bias the forecasts towards $f = 0$ or $f = 2$. This suggest that what matters is not that non-revealing forecasts are more attractive than revealing forecasts. What matters is that there is a gap of attractivity between the two. This gap generates indeed an incentive to bias forecasts. Asking details always closes the attractivity gap between $f = 0$, $f = 1$ and $f = 2$.[17]

*Alternative reasons for asking details*

In this paper, we do not pretend having identified the unique reason for having detailed forecasts. There are actually several potential ways to explain the existence of detailed forecasts. First, a possible reason for asking detail could be to test the expert's ability. If a macroeconomist states for instance that the economy will grow strongly next year but gives a non convincing argumentation, then his prediction can be considered very cautiously. If instead he makes a strong and convincing case for his prediction, then he should be trusted. The details may thus provide information on whether the expert is informed or not and whether his advice/forecast should be taken into account. Second, an empirical study in psychology by Hagafors and Brehmer (1983) suggest that the reliability of the information processing might increase if the expert were asked to justify forecasts verbally. Similarly, Hammond (1996) argues that the human mind is such that requiring forecasts' justification moves the forecasting process away from an intuitive process and toward and analytic process.

[17] It is also important to notice that the revealing forecasts cannot be attractive in our model as long as $g$ is a constant And even $g$ was not a constant across events, it could be only partially possible. This is why we did not consider it.

# 7 Appendix A

- **Proof of Proposition 1**

**Step 1:**

Let us first show that if $b < p_2$ and $b < p_1$ there exists no truthtelling equilibrium. Consider a bad expert with $s_1 = s_2 = 0$. We show that, if all the forecasts are truthful, he always prefers forecasting $f = 1$ to forecasting $f = 0$.

In order to show it, we first need to prove that the incentive to forecast $f = 1$ when $s = 0$ increases with $p_1$ and $p_2$ while the incentive to forecast $f = 0$ increases with $p_1$ and $p_2$. If $s = 0$, the utility of releasing $f = 0$ and $f = 1$ forecasts are respectively:

$U(f = 0) = \Pr(x = 0|s = 0)\Pr(good|x = 0, f = 0) + \Pr(x = 1|s = 0)\Pr(good|x = 1, f = 0) + \Pr(x = 2|s = 1)\Pr(good|x = 2, f = 0)$

$U(f = 1) = \Pr(x = 0|s = 0)\Pr(good|x = 0, f = 1) + \Pr(x = 1|s = 0)\Pr(good|x = 1, f = 1) + \Pr(x = 2|s = 1)\Pr(good|x = 2, f = 1)$

where:

1) $\Pr(x = 0|s = 0) = \Pr(x_1 = 0|s_1 = 0)\Pr(x_2 = 0|s_2 = 0) = \frac{\Pr(s_1=0|x_1=0)}{\Pr(s_1=0|x_1=0)+\Pr(s_1=0|x_1=1)} * \frac{\Pr(s_2=0|x_2=0)}{\Pr(s_2=0|x_2=0)+\Pr(s_2=0|x_2=1)} = \frac{b(1-p_1)}{b(1-p_1)+(1-b)p_1} * \frac{b(1-p_2)}{b(1-p_2)+(1-b)p_2}$

2) $\Pr(x = 1|s = 0) = \Pr(x_1 = 1|s_1 = 0)\Pr(x_2 = 0|s_2 = 0) + \Pr(x_1 = 0|s_1 = 0)\Pr(x_2 = 1|s_2 = 0) = \frac{p_1(1-b)}{p_1(-b)+(1-p_1)b} * \frac{b(1-p_2)}{b(1-p_2)+(1-b)p_2} + \frac{p_2(1-b)}{p_2(-b)+(1-p_2)b} * \frac{b(1-p_1)}{b(1-p_1)+(1-b)p_1}$

3) $\Pr(x = 2|s = 0) = \Pr(x_1 = 1|s_1 = 0)\Pr(x_2 = 1|s_2 = 0) = \frac{p_1(1-b)}{p_1(-b)+(1-p_1)b} * \frac{p_2(1-b)}{p_2(-b)+(1-p_2)b}$

and where, by Bayesian rules:

$\Pr(good|x = 0, f = 0) = \frac{g^2}{g^2+b^2}$

$\Pr(good|x = 1, f = 0) = \Pr(good|x = 0, f = 1) = \Pr(good|x = 2, f = 1) = \frac{g(1-g)}{g(1-g)+b(1-b)}$

$\Pr(good|x = 2, f = 0) = \frac{(1-g)^2}{(1-g)^2+(1-b)^2}$

$\Pr(good|x = 1, f = 1) = \frac{g^2+(1-g)^2}{g^2+(1-g)^2+b^2+(1-b)^2}$

Note that $\frac{g^2+(1-g)^2}{g^2+(1-g)^2+b^2+(1-b)^2} > \frac{g(1-g)}{g(1-g)+b(1-b)}$. Indeed, this is the case if $\frac{g(1-g)}{b(1-b)} < \frac{1-2g+2g^2}{1-2b+2b^2}$. After simplifications, this is equivalent to $g(1-g) < b(1-b)$. This obviously holds.

It is obvious that $\frac{\partial \Pr(x=0|s=0)}{\partial p_1} < 0$ and $\frac{\partial \Pr(x=0|s=0)}{\partial p_2} < 0$. Instead $\frac{\partial \Pr(x=2|s=0)}{\partial p_1} > 0$, $\frac{\partial \Pr(x=2|s=0)}{\partial p_2} > 0$. The sign of $\frac{\partial \Pr(x=1|s=0)}{\partial p_1}$ and $\frac{\partial \Pr(x=1|s=0)}{\partial p_2}$ is also negative because $b < p_1$, $b < p_2$.

Therefore, it is straightforward that the sign of $\frac{\partial U(f=1)}{\partial p_1}$ is positive, while the sign of $\frac{\partial U(f=0)}{\partial p_1} > 0$. Idem for $p_2$. Thus, the higher are $p_1$ and $p_2$, the higher is $U(f=1) - U(f=0)$ when $s = 0$. The incentive to lie is thus the lowest if $p_1$ and $p_2$ go to $b$. We show that even if $p_1$ and $p_2$ go to $b$, the bad experts with $s = 0$ do not release truthful forecasts. This rejects the existence of a truthtelling equilibrium.

Setting $p_1 = b$ and $p_2 = b$ implies that:
$U(f=0) = \frac{1}{4}\frac{g^2}{g^2+b^2} + \frac{1}{2}\frac{g(1-g)}{g(1-g)+b(1-b)} + \frac{1}{4}\frac{(1-g)^2}{(1-g)^2+(1-b)^2}$
$U(f=1) = \frac{1}{4}\frac{g(1-g)}{g(1-g)+b(1-b)} + \frac{1}{2}\frac{g^2+(1-g)^2}{g^2+(1-g)^2+b^2+(1-b)^2} + \frac{1}{4}\frac{g(1-g)}{g(1-g)+b(1-b)}$

Let us now show that $U(f=1) - U(f=0)$ is always positive.
$U(f=0) - U(f=1) = \frac{1}{4}\frac{(1-g)^2}{(1-g)^2+(1-b)^2} + \frac{1}{4}\frac{g^2}{g^2+b^2} - \frac{1}{2}\frac{g^2+(1-g)^2}{g^2+(1-g)^2+b^2+(1-b)^2}$
We call $A = g^2$, $B = g^2 + b^2$, $C = (1-g)^2$ and $D = (1-g)^2 + (1-b)^2$

Thus $U(f=0) - U(f=1) = \frac{1}{2}\left(\frac{A}{B} + \frac{C}{D}\right) - \frac{A+C}{B+D} > 0$ if and only if $D(AD - BC) > B(AD - BC)$

After some algebra, $AD - BC = g^2((1-g)^2 + (1-b)^2) - b^2((1-g)^2)$. The sign of $AD - BC$ is positive because $\frac{g^2}{g^2+b^2} > \frac{(1-g)^2}{(1-g)^2+(1-b)^2}$. Therefore $D(AD - BC) > B(AD - BC)$ is not possible. Thus $U(f=0) - U(f=1) < 0$ and it is always optimal to tell $f = 1$ instead of $f = 0$ for a bad expert.

This proves that if $b < p_1$ and $b < p_2$, truthtelling is not possible.

**Step 2:**

We show now that if $b > p_1$ and $b < p_2$, a truthtelling equilibrium is also impossible. We still consider a bad expert with $s_1 = s_2 = 0$ and show that he prefers forecasting $f = 1$ to $f = 0$.

Let us write $\Pr(x = 1|s = 0) = \frac{p_1(1-b)}{p_1(-b)+(1-p_1)b} * \frac{b(1-p_2)}{b(1-p_2)+(1-b)p_2} + \frac{p_2(1-b)}{p_2(-b)+(1-p_2)b} * \frac{b(1-p_1)}{b(1-p_1)+(1-b)p_1} = p'_1(1-p'_2) + (1-p'_1)p'_2$.

We know that the incentive to release $f = 1$ when $s = 0$ increases for sure with $p_i$ if $\frac{\partial \Pr(x=1|s=0)}{\partial p_i} < 0$. From the former equation, $\frac{\partial \Pr(x=1|s=0)}{\partial p_1} = 1 - 2p'_2$ and $\frac{\partial \Pr(x=1|s=0)}{\partial p_2} = 1 - 2p'_1$. So, by setting $p_2$ to its minimum value $p_2 = b$, we minimize the incentive to lie $U(f = 1) - U(f = 0)$. In that case, it is straightforward that $\Pr(x = 0|s = 0) = \frac{1}{2}\Pr(x_1 = 0|s_1 = 0)$, $\Pr(x = 1|s = 0) = \frac{1}{2}$, $\Pr(x = 0|s = 0) = \frac{1}{2}\Pr(x_1 = 1|s_1 = 0)$. Therefore, $U(f = 0) - U(f = 1)$ simplifies to $\Pr(x_1 = 0)\frac{g^2}{g^2+b^2} + \Pr(x_1 = 1)\frac{(1-g)^2}{(1-g)^2+(1-b)^2} - \frac{g^2+(1-g)^2}{g^2+(1-g)^2+b^2+(1-b)^2}$

The maximal value of $U(f = 0) - U(f = 1)$ is thus $b\frac{g^2}{g^2+b^2} + (1-b)\frac{(1-g)^2}{(1-g)^2+(1-b)^2} - \frac{g^2+(1-g)^2}{g^2+(1-g)^2+b^2+(1-b)^2}$

Let us compute $\frac{\partial U(f=0)-U(f=1)}{\partial g} = \frac{b^3 g}{(g^2+b^2)^2} - \frac{(1-b)^3(1-g)}{((1-g)^2+(1-b)^2)^2} - \frac{(2g-1)(b^2+(1-b)^2)}{(b^2+(1-b)^2+g^2+(1-g)^2)^2}$

This is equal to $\frac{b^3(1-g)}{(g^2+b^2)^2} - \frac{(1-b)^3(1-g)}{((1-g)^2+(1-b)^2)^2} + (2g-1)\left[-\frac{(b^2+(1-b)^2)}{(b^2+(1-b)^2+g^2+(1-g)^2)^2} + \frac{b^3}{(g^2+b^2)^2}\right]$

We can show that $\frac{\partial U(f=0)-U(f=1)}{\partial g} < 0$.

Indeed, $\frac{(1-b)^3(1-g)}{((1-g)^2+(1-b)^2)^2} > \frac{b^3(1-g)}{(g^2+b^2)^2}$ and $\frac{(b^2+(1-b)^2)}{(b^2+(1-b)^2+g^2+(1-g)^2)^2} > \frac{b^3}{(g^2+b^2)^2}$.

Therefore $\frac{\partial U(f=0)-U(f=1)}{\partial g} < 0$. This implies that $U(f = 0) - U(f = 1)$ is maximal if $g$ is the lowest, i.e. if $g = b$. If $g = b$, it is immediate that $U(f = 0) - U(f = 1) = 0$.

This proves that $U(f = 0) - U(f = 1) < 0$ and that no truthtelling equilibrium is possible.

**Step 3:**

Step 1 and step 2 show that there is no truthtelling equilibrium if $b < p_1$ and/or $b < p_2$. We have shown that if $b = p_1 = p_2$, $U(f = 0) - U(f = 1) < 0$ for the expert receiving $s = 0$. Therefore, a truthtelling equilibrium does not exist for all $b$ such that $b > p_1$, $b > p_2$.

- **Proof of Proposition 2**

This proof is similar to Trueman (1994). Nothing really new here. Given that $p_1$ and $p_2 > \frac{1}{2}$, the expert with the highest incentive to deviate from truthtelling is a bad expert with a signal $s_i = 0$. If that expert does not deviate from truthtelling for any $i = \{1, 2\}$, then a truthtelling equilibrium exists.

If $s_i = 0$, the utilities of releasing a truthful forecast $f_i = 0$ or a biased forecast $f_i = 1$ are:

$U(f_i = 0|s_i = 0) = \Pr(e_i = 0|s_i) \Pr(good|e_i = 0, f_i = 0) + \Pr(e_i = 1|s_i) \Pr(good|e_i = 1, f_i = 0)$

$U(f_i = 1|s_i = 0) = \Pr(e_i = 0|s_i) \Pr(good|e_i = 0, f_i = 1) + \Pr(e_i = 1|s_i) \Pr(good|e_i = 1, f_i = 1)$

where:

$\Pr(e_i = 0|s_i) = \frac{(1-p_i)b}{(1-p_i)b+(1-b)p_i}$

$\Pr(e_i = 1|s_i) = \frac{p_i(1-b)}{p_i(1-b)+b(1-p_i)}$

$\Pr(good|e_i = 0, f_i = 0) = \Pr(good|e_i = 1, f_i = 1) = \frac{g}{g+b}$

$\Pr(good|e_i = 1, f_i = 0) = \Pr(good|e_i = 0, f_i = 1) = \frac{1-g}{1-g+1-b}$

Thus $U(f_i = 0) - U(f_i = 1) = [\Pr(e_i = 0|s_i) - \Pr(e_i = 1|s_i)] \left[\frac{g}{g+b} - \frac{1-g}{1-g+1-b}\right]$
which is positive if $\Pr(e_i = 0|s_i) - \Pr(e_i = 1|s_i)$, i.e. if $b > p_i$.

A truthtelling equilibrium therefore exists if $b > p_1$ and $b > p_2$. Otherwise at least the experts with $s_i = 0$ deviate from truthtelling and tell $f_i = 1$ instead of $f_i = 0$.

- **Proof of Proposition 3**

We have shown that if either $p_1 > b$ and/or $p_2 > b$, there exists no truthtelling equilibrium (TE) for both detailed and undetailed forecasts. Therefore asking details is neutral in that case. If $b > p_1$, $b > p_2$, detailed forecasts are always truthful while undetailed forecasts are not necessarily truthful. This is why details can be useful when $p_1$ are $p_2$ are lower than $b$.

- **What if $p_1 < \frac{1}{2}$ and/or $p_2 < \frac{1}{2}$?**

We consider $p_1 > 1 - p_2$. The proof is symmetric if $p_1 < 1 - p_2$. The fact that $p_1 < \frac{1}{2}$ implies that for the undetailed forecasts, $\frac{\partial U(f=1)}{\partial p_2} > 0$. So the minimal incentive to lie if $s = 0$ occurs when $p_1 = 1 - p_2$. If $p_1 = 1 - p_2$ and $b > p_2$, detailed forecasts are always truthful. Asking details can then not hurt. If $p_1 = 1 - p_2$ and $b < p_2$, then there exists obviously no truthtelling detailed forecasts equilibrium. Is there an undetailed forecasts equilibrium? No. Indeed, even if $b = p_2$, an expert receiving $s = 0$ has expost beliefs $\Pr(x = 0|s = 0)\frac{1}{2}b$, $\Pr(x = 1|s = 0)\frac{1}{2}$, $\Pr(x = 2|s = 0)\frac{1}{2}(1 - b)$. At these values, $U(f = 1|s = 0) > U(f = 0|s = 0)$. There exists thus no truthtelling equilibrium.

# 8 Appendix B

- **Proof the the non-verifiability of details does not affect the behavior of experts for undetailed forecasts**

If $e = 0$ or $e = 2$, the values of $e_1$ and $e_2$ can be perfectly infered in both cases. So the non-veriafibility of details has no effect. If $f = 0$ or $f = 2$ and $e = 1$, it has to be that one signal is correct. The reputation depends then not on the verifiability of details. Finally, if $f = 1$ and $e = 1$, the probability of having two correct signals is identical if $e_1 = 0, e_2 = 1$ or if $e_1 = 1, e_2 = 0$. Therefore, in all cases, the reputation does not depend on the verifiability of details. The non-verifiability of details has thus no effect on the behavior.

- **Proof of Proposition 4**

Let us show that if there exists a truthtelling detailed forecasts equilibrium there exists also an undetailed forecasts equilibrium and vice-versa.

We first look at the similarities and differences between the detailed and the undetailed forecasts in terms of reputation.

If $e = 0$ or $e = 2$, details are useless. Indeed, such an undetailed forecast implies that one $s_i$ is correct and one is false. If $f = 0$ or $f = 2$, asking details has no effect on the reputation, whatever the realization of $e$. Indeed, $f = 0$ or $f = 2$ reveal perfectly the private information even if undetailed: the private signals are respectively $s_1 = s_2 = 0$ and $s_1 = s_2 = 1$. Therefore asking details does not bring new information on the private information and has no effect on the reputation. The only case where details potentially have an impact is when $f = 1$ and $e = 1$. Indeed, we saw that when the forecast is not detailed, the reputation when $f = 1$ and $e = 1$ is simply:

$\Pr(good|e = 1, f = 1) = \Pr(good|f = 1, e_1 = 1, e_2 = 0)\Pr(e_1 = 1, e_2 = 0|e = 1) + \Pr(good|f = 1, e_1 = 0, e_2 = 1)\Pr(e_1 = 0, e_2 = 1|e = 1)$

$$= \frac{g^2+(1-g)^2}{g^2+(1-g)^2+b^2+(1-b)^2}\frac{p_1}{p_1+p_2} + \frac{g^2+(1-g)^2}{g^2+(1-g)^2+b^2+(1-b)^2}\frac{p_2}{p_1+p_2} = \frac{g^2+(1-g)^2}{g^2+(1-g)^2+b^2+(1-b)^2}$$

This reputation value $\frac{g^2+(1-g)^2}{g^2+(1-g)^2+b^2+(1-b)^2}$, however, does not hold for detailed forecasts as experts have the possibility to give credible details. We consider that $p_1 > p_2$ for simplicity. This means that $e_1$ is more likely to equal 1 than $e_2$. In this case, detailed forecasts increase the reputation if $f = 1$ and $e = 1$ provided that the details are $f_1 = 1$ and $f_2 = 0$. Releasing the details $f_1 = 0$ and $f_2 = 1$ is instead harmful. This can be shown with some algebra:

$\Pr(good|e = 1, f_1 = 1, f_2 = 0)$

$= \Pr(good|f_1 = 1, f_2 = 0, e_1 = 1, e_2 = 0)\Pr(e_1 = 1, e_2 = 0|f_1 = 1, f_2 = 0, e = 1) + \Pr(good|f_1 = 1, f_2 = 0, e_1 = 0, e_2 = 1)\Pr(e_1 = 0, e_2 = 1|f_1 = 1, f_2 = 0, e = 1)$

$$= \frac{g^2}{g^2+b^2}\left(\frac{(g^2+b^2)}{(g^2+b^2)+((1-g)^2+(1-b)^2)q}\right) + \frac{(1-g)^2}{(1-g)^2+(1-b)^2}\left(\frac{((1-g)^2+(1-b)^2)q}{(g^2+b^2)+((1-g)^2+(1-b)^2)q}\right)$$

where $q = \frac{p_2(1-p_1)}{p_1(1-p_2)} < 1$

This is the reputation when $f_1 = 0$ and $f_2 = 1$ and $e = 1$. If $p_1 = p_2$ it can be simplified to $\frac{g^2+(1-g)^2}{g^2+(1-g)^2+b^2+(1-b)^2}$. If $p_1 > p_2$, it is higher than $\frac{g^2+(1-g)^2}{g^2+(1-g)^2+b^2+(1-b)^2}$. Indeed, $p_1$ increases the weight put on $\frac{g^2}{g^2+b^2}$ and decreases the weight put on $\frac{(1-g)^2}{(1-g)^2+(1-b)^2}$. To sum up, asking details increases the reputation if $f = 1$ and $e = 1$ because experts give credible details. In equilibrium, all the experts forecasting $f = 1$ will give credible details whatever their private signals. Telling credible details will thus be equivalent to telling no details. Therefore, in equilibrium, $\Pr(good|e = 1, f_1 = 1, f_2 = 0) = \Pr(good|e = 1, f = 1)$. This cancels the credible details effect. There are thus no differences between detailed and undetailed forecasts in equilibrium. As a result, asking details has no effect on the existence of a truthtelling equilibrium.

- **Proof of Proposition 5**

In the proof of Proposition 4, we have shown that the only difference between detailed and undetailed forecasts occurs when $f = 1$ and $e = 1$. In equilibrium, however, given that all experts telling $f = 1$ give the same details $f_1 = 1$ and $f_2 = 0$, details become irrelevant. If some experts are honest, this is not true anymore. Indeed, even if all careerist experts tell credible details $f_1 = 1$ and $f_2 = 0$, honest experts do not. Therefore, credible details are still informative on an expert signals. To show it, here is the reputation of for an experts forecasting $f_1 = 1$ and $f_2 = 0$ when $e = 1$ :

$\Pr(good|e = 1, f_1 = 1, f_2 = 0) = \Pr(good|e = 1, s_1 = 1, s_2 = 0) \Pr(s_1 = 1, s_2 = 0|f_1 = 1, f_2 = 0, e = 1)$

$+\Pr(good|e = 1 s_1 = 0, s_2 = 1) \Pr(s_1 = 0, s_2 = 1|f_1 = 1, f_2 = 0, e = 1)$

Similarly:

$\Pr(good|e = 1, f_1 = 0, f_2 = 1) = \Pr(good|e = 1, s_1 = 1, s_2 = 0) \Pr(s_1 = 1, s_2 = 0|f_1 = 0, f_2 = 1, e = 1)$

$+\Pr(good|e = 1, s_1 = 0, s_2 = 1) \Pr(s_1 = 0, s_2 = 1|f_1 = 0, f_2 = 1, e = 1)$

Thus $\Pr(good|e = 1, f_1 = 1, f_2 = 0) - \Pr(good|e = 1, f_1 = 0, f_2 = 1)$

$= [\Pr(good|e = 1, s_1 = 1, s_2 = 0) - \Pr(good|e = 1 s_1 = 0, s_2 = 1)]$

$* [\Pr(s_1 = 1, s_2 = 0|f_1 = 1, f_2 = 0, e = 1) - \Pr(s_1 = 1, s_2 = 0|f_1 = 0, f_2 = 1, e = 1)]$

where $\Pr(good|e = 1, s_1 = 1, s_2 = 0)$

$= \Pr(good|e_1 = 1, e_2 = 0, s_1 = 1, s_2 = 0) \Pr(e_1 = 1, e_2 = 0|e = 1, s_1 = 1, s_2 = 0)$

$+ \Pr(good|e_1 = 0, e_2 = 1, s_1 = 1, s_2 = 0) \Pr(e_1 = 0, e_2 = 1|e = 1, s_1 = 1, s_2 = 0)$

$= \frac{g^2}{g^2+b^2} \left( \frac{(g^2+b^2)}{(g^2+b^2)+((1-g)^2+(1-b)^2)q} \right) + \frac{(1-g)^2}{(1-g)^2+(1-b)^2} \left( \frac{((1-g)^2+(1-b)^2)q}{(g^2+b^2)+((1-g)^2+(1-b)^2)q} \right)$

Similary, $\Pr(good|e = 1, s_1 = 1, s_2 = 0) =$

$\frac{g^2}{g^2+b^2} \left( \frac{(g^2+b^2)q}{(g^2+b^2)q+((1-g)^2+(1-b)^2)} \right) + \frac{(1-g)^2}{(1-g)^2+(1-b)^2} \left( \frac{((1-g)^2+(1-b)^2)}{(g^2+b^2)q+((1-g)^2+(1-b)^2)} \right)$

Therefore, $\Pr(good|e = 1, s_1 = 1, s_2 = 0) - \Pr(good|e = 1 s_1 = 0, s_2 = 1) > 0$.

Given that $\Pr(s_1 = 1, s_2 = 0|f_1 = 1, f_2 = 0, e = 1) - \Pr(s_1 = 1, s_2 = 0|f_1 = 0, f_2 = 1, e = 1) > 0$, it turns out that

$\Pr(good|e = 1, f_1 = 1, f_2 = 0) - \Pr(good|e = 1, f_1 = 0, f_2 = 1) > 0$

But is it that $\Pr(good|e = 1, f_1 = 1, f_2 = 0) > \Pr(good|e = 1, f = 1)$? Yes.

Indeed, $\Pr(good|e = 1, f = 1) = \Pr(good|e = 1, s_1 = 1, s_2 = 0) \Pr(s_1 = 1, s_2 = 0|f = 1, e = 1)$

$+\Pr(good|e = 1 s_1 = 0, s_2 = 1) \Pr(s_1 = 0, s_2 = 1|f = 1, e = 1)$ which is obviously smaller than $\Pr(good|e = 1, f_1 = 1, f_2 = 0)$.

Asking details increases thus the utility of the agents releasing the $f = 1$ forecast. This shows that credible details do matter in this model even in equilibrium. Note that if $p_1 = p_2$ it turns out that $\Pr(good|e = 1, s_1 = 1, s_2 = 0) - \Pr(good|e = 1 s_1 = 0, s_2 = 1) = 0$. In that case, details are useless. Now that we have identified the effect of detailed forecasts, it is easier to see under which conditions a TE exists. The unique difference between detailed and undetailed forecasts is that, due to the credible details effect, the attractivity of $f = 1$ is higher for detailed forecasts. Undetailed forecasts were already typically biased towards $f = 1$. Asking details can thus worsen this bias and a TE will require a even higher $b$. In order to show this possibility, consider the following parameters' values:

$p_1 = 0.55$

$p_2 = 0.8$

$b = 0.85$

$g = 0.95$

$\lambda = \frac{1}{2}$

Section 5.3 shows that with these values there exists no detailed forecasts truthtelling equilibrium but there exists an undetailed forecasts truthtelling equilibrium.

- **Proof for the numerical example, section 5.3.2**

We have shown that:

$\Pr(good|e = 1, f_1 = 1, f_2 = 0) = \Pr(good|e = 1, s_1 = 1, s_2 = 0) \Pr(s_1 = 1, s_2 = 0|f_1 = 1, f_2 = 0, e = 1)$

$+\Pr(good|e = 1 s_1 = 0, s_2 = 1) \Pr(s_1 = 0, s_2 = 1|f_1 = 1, f_2 = 0, e = 1)$

where $\Pr(good|e = 1, s_1 = 1, s_2 = 0) = 0.5188$, $\Pr(good|e = 1 s_1 = 0, s_2 = 1) = 0.5003$.

We also compute $\Pr(s_1 = 1, s_2 = 0 | f_1 = 1, f_2 = 0, e = 1)$ and find that $\Pr(good | e = 1, f_1 = 1, f_2 = 0) = 0.55$

## References


[1] Bernhardt, D., Campello, M. and Kutsoati, E. (2004). "Who Herds?" mimeo, University of Illinois.

[2] Chen, Q. and Jiang, W. (2003). "Analysts' Weighting of Private and Public Information." *Review of Financial Studies*, forthcoming.

[3] Effinger, M. and Polborn, M. (2001). "Herding and Anti-Herding : A Model of Reputational Differentiation." *European Economic Review*, 45, 385-403.

[4] Glazer, J. and Rubinstein, A. (1998) "Motives and Implementation: On the Design of Mechanisms to Elicit Opinions." *Journal of Economic Theory*, 79(2), 157-173.

[5] Glazer, J. and Rubinstein, A. (2001) "Debates and Decisions: On a rationale of Argumentation Rules." *Games and Economic Behavior*, 36, 158-173.

[6] Hagafors, R. and Brehmer, B. (1983). "Does Having to Justify One's Judgment's Change the Nature of the Judgment Process?" *Organizational Behavior and Human Performance*, 31, 223-232.

[7] Hammond, K. (1996). "Human Judgment and Socila Policy: Irreductible Uncertainty, Inevitable Error, Unavoidable Injustice." New york: Oxford University Press

[8] Klevorick, A., Rothschild, M. and Winship, C. (1984). "Information Processing and Jury Decision Making." *Journal of Public Economics*, 23 (3), 245-278.

[9] Loungani, P. (2000). "How Accurate Are Private Sector Forecasts? Cross-Country Evidence from Consensus Forecasts of Output Growth." *IMF Working Paper*, 00-77.

[10] Ottaviani, M. and Sorensen, P. (2001). "Information Aggregation in Debate: Who Should Speak First?" *Journal of Public Economics*, 81, 393-421.

[11] Ottaviani, M. and Sorensen, P. (2005). "The Strategy of Professional Forecasting." *London Business School.*

[12] Prendergast, C. and Stole, L. (1996). "Impetuous Youngsters and Jaded Old-Timers: Acquiring a Reputation for Learning." *Journal of Political Economy*, 104, 1105-1134.

[13] Scharfstein, D. and Stein, J. (1990). "Herd Behavior and Investment." *American Economic Review*, 80(3), 465-479.

[14] Trueman, B. (1994) "Analyst Forecasts and Herding Behavior." *The Review of Financial Studies,* 7, 97-124.

[15] Zarnowitz, V. (1986). "The Record of Improvability of Economic Forecasting." *NBER Working Paper,* No 2099.

[16] Zitzewitz, E. (2001), "Measuring Exaggeration by Analysts abd Other Opinion Producers." mimeo, Stanford University, Graduate School of Business.

[17] Zwiebel, J. (1995). "Corporate Conservatism and Relative Compensation." *Journal of Political Economy*, 103, 1-25