Why Forecasters Disagree? A Global Games Approach*

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Abstract

Two key features of economic forecasts are that (i) they are based on incomplete information about the underlying fundamentals; and (ii) they reveal private information that the corresponding forecasters have. These features are exactly reminiscent of global games – games of incomplete information where players receive (possibly) correlated signals of the underlying states of the economy. In this paper, we use a global games approach to explain dispersion in economic forecasters' predictions. First, we analyze a stylized "beauty-contest" model to characterize conditions under which dispersion among forecasts persists. In particular, dispersion increases when the precision of public signal is sufficiently high enough. We also discuss related issues regarding the development of information technology, costs of obtaining information, and their effects on the information acquisition motives of economic forecasters. This paper represents a first attempt to explain the existence and the persistence of differences among forecasts in the context of global games.

Keywords: Dispersion of forecasts, global games, signals.

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1 Introduction

It is well-known that disagreement[1] among economic forecasters has been persistent over time.[2] A natural question that follows from this observation is: Why dispersion in forecasts exists and is persistent? Patton and Timmermann (2010) argue that persistent disagreement among forecasters can be explained by "heterogeneity in priors or models" rather than "differences in information sets." In this paper, contrary to Patton and Timmermann (2010), we develop a novel approach for explaining dispersion among forecasters through the lens of global games.

Why global games? First, the nature of forecasts stems from incomplete information about the underlying states of the economy, i.e., macroeconomic conditions. For example, the exact output level of the next period is not known to economic agents in advance; instead, agents observe various signals[3] about the fundamentals of the economy and form expectations about future output growth based on information that one obtains from the signals. Second, each forecaster takes into consideration other forecasters' actions (or, forecasts). Because each forecaster's action might reveal her private information that others do not have, an individual forecaster may want to mimic others' actions due to the complementarity of their actions[4]; or an individual forecaster may want to deviate from others' actions due to the substitutability of their actions.[5]

These two features of economic forecasts are consistent with the key elements of global games. To our knowledge, our paper represents a first attempt to explain the existence and the persistence of dispersion among forecasts theoretically by a global games approach.

The following is the list of issues that we address in this paper:

1. Which global games model can explain dispersion of forecasts?

2. Information technology (henceforth, IT) has developed over time. Everyone can easily access information via the internet today whereas it was not easily possible in the past. The development of technology clearly plays a significant role in making disparity in information among economic agents to diminish. Then, why does dispersion of forecasts still persists substantially? We may consider the following two cases:

    - The precision of public information signal increases.

    - Allow agents to buy information at some cost; and the cost declines.

3. Rudebusch and Williams (2009) find that "[f]or over two decades, researchers have provided evidence that the yield curve, specifically the spread between long- and short-term interest rates, contains useful information

[1] We use the terms *dispersion* and *disagreement* interchangeably.

[2] See p.805 of Patton and Timmermann (2010).

[3] For example, news from the stock market or announcements of the Fed.

[4] For instance, consider the possibility that buyers of information can punish a forecaster when his forecast is too different from other forecasters'.

[5] Consider a case in which a forecaster can be renowned for his distinctive forecast. Two exemplary scholars are Nouriel Roubini and Raghuram Rajan, who predicted the 2008 financial crisis while many others could not.

for signaling future recessions. Despite these findings, forecasters appear to have generally placed too little weight on the yield spread when projecting declines in the aggregate economy."[6] This phenomenon can be possibly explained as the optimal responses of forecasters when it is *costly* to use (or obtain) the new sets of information.

4. Rondina and Shim (2013) show that 'endogenous' public information can distort the information acquisition motive of an economic forecaster. Would this also be important in our model?

In the next section, we present a simple but parsimonious framework as a benchmark model for further analysis. In particular, we show whether better public information or better private information can explain persistent dispersion of forecasts. Better public information can be a consequence of the development of information technology. This can be justified by the fact that more public information can now be easily obtained via the internet. Also, what the government and/or the Fed do has become more transparent to forecasters. Better private information can be interpreted as improved private signals also due to easy accessibility to technology by individuals.

2 Model

We consider a forecasting game based on the "beauty-contest" type model following Angeletos and Pavan (2007), Morris and Shin (2002), and Rondina and Shim (2013). A forecaster solves an expected utility maximization problem of the form:

$$a(A, p) = arg \max \mathbb{E}\left[u(a, A(\theta, p), \theta) | x, p\right], \tag{2.1}$$

where $u(a, A, \theta) = -\frac{1}{2}\left(a - (1-r)\theta - rA\right)^2$, $r \in (-1, 1)$, $A(\theta, p) = \int_x a(x, p) d\bar{\Psi}(x|\theta, p)$, and $\bar{\Psi}(x|\theta, p)$ denotes the conditional distribution of x given (θ, p).

Here, θ denotes an economic variable that is uncertain to forecasters. We assume that θ is drawn from an improper distribution. a denotes the guess of an individual forecaster (or agent or player) about θ; and A denotes the average guess about θ. We assume a quadratic utility function to preserve the linearity of the solution.[7] Finally, r shows whether the forecasting game exhibits complementarity ($r > 0$) or substitutability ($r < 0$).

Note that the utility function captures the key properties of the forecasting game: On the one hand, a forecaster would like to make a good guess about the economic variable, θ, because she will be punished if the guess is different from θ; on the other hand, she would also like to make a similar guess with other forecasters when $r > 0$ while she prefers to be different from others when $r < 0$.

[6] See Rudebusch and Williams (2009).

[7] Another possibility is to think of the utility function as an approximation to the usual concave function.

Each forecaster receives two (or possibly more) signals: a private signal x_i and a public signal p, respectively, characterized as

$$x_i = \theta + (\alpha_{x,i})^{-1/2}\varepsilon_i \tag{2.2}$$

and

$$p = \theta + (\alpha_p)^{-1/2}\varepsilon, \tag{2.3}$$

where ε_i and ε are i.i.d. and both follow $\mathbb{N}(0,1)$. $\alpha_{x,i}$ and α_p denote precision of private and public signals, respectively. We may allow information choice at the beginning of the game so that private signal is indexed by i where $i \in [0,1]$.[8]

Note that with complete information, we have $a^* = A^* = \theta$. So there exists no dispersion in forecasts. However, with incomplete information, the optimal forecast of each forecaster is given by[9]

$$a_i(x_i, p) = \psi_i \Lambda x_i + (1 - \psi_i \Lambda)p \tag{2.4}$$

with

$$\psi_i = \frac{\alpha_{x,i}}{\alpha_{x,i} + \alpha_p} \text{ and } \Lambda = \frac{\alpha_x + \alpha_p}{\alpha_x + \frac{\alpha_p}{1-r}}.$$

For simplicity, we focus on symmetric equilibria where $\alpha_{x,i} = \alpha_{x,j}$ for $i \neq j$. Following Angeletos and Pavan (2004), we obtain the following expression for dispersion of forecasts for given realizations of θ and p:

$$Var(a|\theta, p) = (\psi\Lambda)^2 (\alpha_x)^{-1} = \frac{\alpha_x}{\left(\alpha_x + \frac{\alpha_p}{1-r}\right)^2} \tag{2.5}$$

where $\psi\Lambda = \frac{\alpha_x}{\alpha_x + \frac{\alpha_p}{1-r}}$.

Now we analyze how changes in α_p, the precision of public information signal, affect dispersion of forecasts:

Proposition 1 (Effect of Better Public Information on Dispersion of Forecasts)**.** *Suppose that α_p increases due to the development of information technology. Then, dispersion of forecasts* ***declines****.*

Proof. Obvious from equation (2.5). □

Hence in this simple framework, the development of IT cannot be interpreted as the improvement in informativeness of public information signal. The intuition is as follows. As public information gets better, each forecaster puts more weight on public signal when she makes a prediction. As a result, forecasts of each individual become similar. Thus, we need to consider other features to explain the persistence of dispersion.

[8] The measure of forecasters is assumed to be one.
[9] For the derivation, see Rondina and Shim (2013).

The following Proposition 2 characterizes what happens to dispersion of forecasts if we instead interpret the development of information technology as increases in α_x.

Proposition 2 (Effect of Better Private Information on Dispersion of Forecasts)**.** *Suppose that α_x increases due to the development of information technology. Then, dispersion of forecasts **declines** when $\alpha_p < (1-r)\alpha_x$ and **increases** when $\alpha_p > (1-r)\alpha_x$.*

Proof. We differentiate $Var(a|\theta, p)$ with respect to α_x to obtain

$$sign\left(\frac{dVar(a|\theta, p)}{d\alpha_x}\right) = sign\left(\frac{\alpha_p}{1-r} - \alpha_x\right) \tag{2.6}$$

Then the proposition follows. □

Through this simple exercise, we show that our model based on a beauty-contest model can explain the persistent dispersion of forecasts despite the information revolution. In particular, dispersion of forecasts rises if the precision of public information signal is sufficiently high enough. Note that it is equally possible for the precisions of both signals to be high.

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