Journal of Economic Dynamics & Control 88 (2018) 51–69

Contents lists available at ScienceDirect

Journal of Economic Dynamics & Control

journal homepage: www.elsevier.com/locate/jedc

Effects of different ways of incentivizing price forecasts on market dynamics and individual decisions in asset market experiments☆

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ARTICLE INFO

Article history:
Received 3 October 2017
Revised 8 January 2018
Accepted 8 January 2018

JEL classification:
C90
D84

Keywords:
Price forecast elicitation
Experimental asset markets

ABSTRACT

In this study, we investigate (a) whether eliciting future price forecasts influences market outcomes and (b) whether differences in the way in which subjects are incentivized to submit "accurate" price forecasts influence market outcomes as well as the forecasts in an experimental asset market. We consider four treatments: one without forecast elicitation and three with forecast elicitation. In two of the treatments with forecast elicitation, subjects are paid based on their performance in both forecasting and trading, while in the other treatment with forecast elicitations, they are paid based on only one of those factors, which is chosen randomly at the end of the experiment. We found no significant effect of forecast elicitation on market outcomes in the latter case. Thus, to avoid influencing the behavior of subjects and market outcomes by eliciting price forecasts, paying subjects based on either forecasting or trading performance chosen randomly at the end of the experiment is better than paying them based on both. In addition, we consider forecast-only experiments: one in which subjects are rewarded based on the number of accurate forecasts and the other in which they are rewarded based on a quadratic scoring rule. We found no significant difference in terms of forecasting performance between the two.

1. Introduction

Expectations play a central role in modern macroeconomics and financial economics. Further, various policies, both monetary and fiscal, have increasingly come to be viewed as influencing the expectations of people, in particular market participants (Honkapohja, 2015; Mertens and Ravn, 2014). However, there is still considerable room for research into the

☆ We thank anonymous referees and an associate editor for constructive comments. Makoto Soga provided invaluable help in organizing the experiments. This project is partly financed by L'Institute Universitaire de France, the ANR ORA-Plus project "BEAM" (ANR-15-ORAR-0004), and JSPS KAKENHI Grant Numbers 26285043, 26350415, 26245026, and 26590026. It also benefited from financial support from the French government managed by l'Agence Nationale de la Recherche under Investissements d'Avenir *UCA*^{JEDI} (ANR-15-IDEX-01). In particular, we thank the UCAinACTION project. We also thank Edanz Group (www.edanzediting.com) for editing a draft of this manuscript. The experiments reported in this paper have been approved by the Institutional Review Board of the Faculty of Engineering, Information and Systems, University of Tsukuba (No. 2012R25).

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https://doi.org/10.1016/j.jedc.2018.01.018
0165-1889/

dynamics of expectation formations to better understand how such policies influence the expectations and behavior of market participants.

In studying the dynamics of expectation formations, laboratory experiments provide a powerful tool. Unlike field data, whereby researchers rarely have full knowledge of the information on which people base their expectations, laboratory experiments enable researchers to determine what kind of information subjects have access to. For example, recent studies on "learning-to-forecast experiments" (Bao and Hommes, 2014; Bao et al., 2012; Heemeijer et al., 2009; Hommes et al., 2005; Sonnemans and Tuinstra, 2010) have been very successful in demonstrating the kinds of market environments under which the price expectations of subjects quickly converge to the rational expectations equilibrium (REE). These experimental studies also demonstrate the complex dynamics of expectations that do not converge to the REE and contribute to the construction of new type of models of expectation formation/dynamics by providing researchers with data against which proposed models can be tested (see, e.g., Anufriev and Hommes, 2012; Anufriev et al., 2015).[1]

The importance of studying expectation dynamics in other experimental paradigms is increasingly acknowledged among researchers. For example, in a recent survey of a large body of experimental literature that emerged after the seminal study by Smith et al. (1988), Palan (2013) discusses the scarcity of existing studies, as well as the need for more research, investigating the dynamics of expectations regarding future prices in multi-period asset markets.[2]

A potential obstacle to future developments in this direction is that as yet, there is no consensus regarding the most appropriate methodology regarding forecast elicitations. For example, it is not yet understood how eliciting forecasts influences market outcomes such as the degree of mispricing or trade volumes.[3] One recent study investigating this issue is (Bao et al., 2013) using the framework of the "learning-to-forecast experiment." These authors examine cobweb markets in which subjects undertake (1) only forecasting (with computers implementing optimal trading behavior based on the submitted forecasts), (2) only trading (i.e., there is no elicitation of price forecasts), or (3) both forecasting and trading. Bao et al. (2013) find that market prices converge to the REE, but at significantly different speeds. The convergence is fastest when subjects only undertake forecasting and slowest when subjects undertake both forecasting and trading, suggesting that when subjects need to engage in multiple tasks, they take longer to learn "optimal" trading behavior.

Furthermore, researchers use different means of incentivizing subjects for their performance in forecasting and trading when they engage in both activities. In some studies, subjects are rewarded for both their forecasting and trading performances. Typically, in these studies, forecasting performance is rewarded by a bonus payment in addition to the reward from trading performance (Akiyama et al., 2014, 2017; Bosch-Rosa et al., 2017; Haruvy et al., 2007).[4] In other studies, subjects are rewarded based on their performance in relation to one of the two activities, but not both, and the activity that is used for this purpose is randomly determined at the end of the experiment (Bao et al., 2017). In comparing the two incentive schemes, researchers often discuss the possibility of subjects hedging between forecasting and trading when they are incentivized in relation to both activities (see, for example, Bao et al., 2017). While the observed trading behaviors may well differ between the two incentive schemes discussed above, to the best of our knowledge, there is no systematic experimental study investigating precisely how this difference in the way in which subjects are rewarded influences their behavior and forecasts.

This study aims to fill this gap in the literature. Using the experimental asset market paradigm pioneered by Smith et al. (1988), we investigate (a) whether (and how) eliciting future price forecasts influences market outcomes and (b) whether (and how) differences in the way in which subjects are incentivized in relation to their forecasting and trading performance, i.e., whether they are rewarded for either forecasting or trading (randomly determined at the end of the experiment), or for both, influence market outcomes, as well as the forecasts they submit. Further, to investigate (c) how two different ways of measuring forecast performance, a quadratic scoring function and a step function, and (d) how two different levels of reward for "accurate" forecasts impact subjects' forecasting performance, we conduct additional forecasting-only experiments in which subjects do not trade at all, but merely forecast the prices observed in our treatment without forecast elicitation.

We find that eliciting forecasts can significantly increase the magnitude of mispricing when subjects are rewarded for both trading and forecasting performance. If they are only rewarded for either forecasting or trading performance, chosen randomly at the end of the experiment, the market outcomes are not significantly different from those in the treatment without forecast elicitation. Thus, to avoid influencing the behavior of subjects and market outcomes by eliciting price forecasts compared with the benchmark case without forecast elicitation, subjects should be rewarded based on

[1] Beshears et al. (2013) conduct forecasting-only experiment to study whether subjects correctly perceive the dynamics of a mean reverting time series. They show that if the mean-reverting process is fast, most of the subjects recognize it. But if it is slow, none of the subjects does.

[2] See also Powell and Shestakova (2016) and Nuzzo and Morone (2017) for a more recent survey of this rapidly growing body of literature.

[3] This lack of methodological consensus was evident in a discussion held among prominent scholars in the field, such as Vernon Smith, Charles Noussair, and Bruno Biais, during the annual meeting of the Society for Experimental Finance held in Nijmegen, in the Netherlands in June 2015. Vernon Smith noted that in analyzing the data from the initial experiments related to Smith et al. (1988) with one-period-ahead forecast elicitation, they felt that eliciting a forecast was influencing the trading behavior of subjects, and thus market outcomes, and therefore ceased to elicit forecasts in the subsequent sessions.

[4] Marimon et al. (1993) was the first study to offer a small bonus for the subject with the best forecast in addition to the rewards provided for the main experimental task.