Household Overreaction*

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Abstract

Coibion and Gorodnichenko (2015a) show slow adjustment of professional forecasters to news information, while Bordalo et al. (2020) find that professional forecasters overreact to news. Using a large-scale survey of households, we examine how households revise expectations about financial variables in response to news. We find that information sets are updated infrequently. In fact, more than half of households are inattentive to information about stock index and foreign exchange rates. However, households overreact to incoming news about the financial variables. In particular, households are more responsive to pessimistic shocks that may decrease their consumption levels than to optimistic news that may not. This overreaction of households is consistent with diagnostic expectations *a la* Bordalo et al. (2020).

JEL Classification: C53; D84; E31
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1 Introduction

Using a large-scale survey of households, we examine how households form expectations about financial variables. First, we find that households overreact to incoming news about financial variables. Second, households are more responsive to pessimistic shocks that may decrease their consumption levels than to optimistic news that may not. Overreaction in financial expectations by households is consistent with diagnostic expectations *la* Bordalo et al. (2020).

Our study is related to the literature on how economic agents react to incoming information. The sticky information hypothesis predicts slow adjustment to news, while diagnostic expectations *a la* Bordalo et al. (2020) predict overreaction to it. Regarding how economic agents react to news, Coibion and Gorodnichenko (2015b) show that household inflation expectations are responsive to an increase in oil prices. Pfajfar and Santoro (2013), and Ehrmann et al. (2017) document that inflation expectations are related to news on inflation. Baqaee (2020) shows heterogeneous responses of households to different types of news: household inflation expectations are more responsive to inflationary news than disinflationary news. While the literature is basically in line with the sticky information hypothesis in the sense of slow adjustment to news, that is, *underreaction* to news, a recent paper by Bordalo et al. (2020) instead finds *overreaction* to it. Using aggregate data on professional forecasts, Bordalo et al. (2020) find systematic *underreaction* to news. On the other hand, they find overreaction to it on a micro-data basis. They presented a model based on the diagnostic expectations of professionals in order to explain the dissonance

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between micro and macro data.[1] While there is mixed evidence about underreaction and overreaction, mainly among professional forecasters, there is sparse evidence about households' reaction to news. However, since our survey collects multi-horizon forecasts over the next three and six months, we can investigate how households revise forecasts in response to news and whether their responsiveness are symmetric to "good" and "bad" news. Our findings contribute to the existing literature by presenting household overreaction and asymmetric responses to news.

2 Survey and households' forecasts

This section summarizes survey data on households' forecasts of the stock price index and foreign exchange rates and shows the basic statistics. We conducted a quarterly online survey of Japanese households from 2015Q4 to 2019Q4 to collect forecasts on Nikkei 225 and USD/JPY over the short and long terms. Every quarter, approximately 30,000 consumers provide an outlook on changes in financial variables in Japan.[2]

As far as we know, our survey is novel. First, large-scale household surveys of forecasts of financial variables are rare, although inflation expectations of households and outlook about future economic conditions are available. The main exception is the Surveys of Consumers at the University of Michigan, which include a survey of forecasts on interest rates. However, they does not include forecasts of stock index or foreign exchange rates. Second, our survey asks households to answer forecasts over multi-horizons. Multi-horizon forecasts allow us to examine the predictability of forecast errors from forecast revisions. Surveys of households with multi-horizon forecasts are sparse, and this is the first study to analyze how forecasts by households are revised and influence forecast errors using fixed-event forecasts. Third, our data are both cross-sectionally and longitudinally "rich" Our survey covers more than 50,000 respondents each wave; these cross-sectionally rich data allow us to conduct a deeper analysis using the subdivided samples. At the same time, while the literature often utilizes "one-shot" survey on households' forecasts, our data are repeated panel data gathered quarterly from the fourth quarter of 2015 to the end of 2019. These large-scale household survey data are well worth analyzing.[3]

Using Questions (1)(a) and (1)(b), we can obtain point forecasts on Nikkei 225 and USD/JPY. Because we ask respondents to answer forecasts over multi-horizons, the survey allows us to regress forecast revisions over the "fixed-event" horizon on forecast errors using forecasts over the next three- and six-month horizons.

Households' forecasts on Nikkei 225 and USD/JPY

Using answers from Questions (1)(a) and (1)(b), we compute percent change of forecasts on Nikkei 225 and USD/JPY from the average of Nikkei 225 and USD/JPY during each survey wave.[4] For example, suppose that response on Nikkei 225 forecast over the next three months is 20,240, and the average of the Nikkei 225 during the survey wave is 20,000. The forecasted percent change in the Nikkei 225 is then calculated as 1.2%. In a similar vein, when forecasted USD/JPY

[1] Bordalo et al. (2018) also discuss diagnostic expectations.

[2] Each quarter, we ask approximately 60,000 online observers, who are registered with INTAGE Inc., to present an outlook on the financial variables. Observations over all survey waves are 644,009. The response rate of the online survey is approximately 60%. Thus, the sample size is approximately 38,000 each quarter.

[3] Respondents are asked the following questions:

(1) Outlook of the levels of Nikkei 225 and USD/JPY over shorter and longer horizons.

(a) "What do you think will be the levels of Nikkei 225 over the next three- and six-month and three-year horizons? Provide index-level figures over each horizon."

(b) "What do you think will be the levels of USD/JPY over the next three- and six-month and three-year horizons? Provide index-level figures over each horizon."

[4] Not every respondent forecasts Nikkei 225 and USD/JPY. The response rates of the forecasts for Nikkei 225 and USD/JPY are 31.2%and 38.7%, respectively.

over the next three months and average USD/JPY during the survey wave are 98.60 and 100.00, respectively, the forecasted percent change in USD/JPY is calculated as -1.4%.

Overall, the absolute values of average forecasts on Nikkei 225 and USD/JPY are larger when forecasters are female, "Low Income", and/or "No Investments."[5]

To formally test whether the covariates of households can predict the forecasts of each household, we regress their forecasts on socioeconomic factors. The estimating equation is the following:

$$\log\left(\frac{\mathbb{F}_t^i[k_{t+h,t}]}{k_t}\right) = \mathbf{X}\beta + \eta_{t+h,t}^i, \tag{1}$$

where $\mathbb{F}_t^i[k_{t+h,t}]$ and k_t are denoted as (level) forecasts of the Nikkei 225 or USD/JPT over the next h horizons and forecasting values at survey date t,[6] and $\mathbf{X}$ and $\eta_{t+h,t}^i$ are the control variables and residuals, respectively. The control variables include socioeconomic factors such as age and gender, 'NonCollege Grad,' 'Low Income,' 'No Investments' dummies.[7] When $h = 1$, $\mathbb{F}_t^i[k_{t+1,t}]$ are forecasts over the next three months. When $h = 2$, $\mathbb{F}_t^i[k_{t+2,t}]$ are forecasts over the next six-month horizon.

The estimation results show that forecasts by females, low-income groups, and those who do not invest in stocks significantly deviate from average forecasts.[8] Their forecasts on Nikkei 225 are significantly smaller than those of males, high-income groups, and those who invest in stocks. This may reflect the former groups' pessimistic outlook on stock markets. That is complemented by their USD/JPY forecasts, which are larger than those of males, high-income groups, and those who invest in stocks. This may reflect the former groups' pessimistic outlook about the local currency (Japanese Yen). The evidence thus supports that socioeconomic factors can predict forecasts.

3 Household overreaction

Mankiw and Reis (2002) first argued that sticky information—the slow dispersal of information about macroeconomic conditions—can help account for sluggish adjustments in prices and real effects that occur in response to monetary shocks. Their fundamental idea is that all agents do not always update their information sets. Thus, their model assumes that inattentive agents process information less frequently. Under the assumption that all agents do not necessarily update their information sets, it is necessary to disperse forecasts made by each agent. The situation can be written as follows:

$$\mathbb{F}_t[k_{t+h}] = (1-\lambda)\sum_{j=0}^{\infty}\lambda^j\mathbb{E}_{t-j}[k_{t+h}], \tag{2}$$

where inattentive agents update their information set in each period with probability $(1-\lambda)$ and $\mathbb{E}$, $\mathbb{F}$, and k_t are full-information rational expectations, average forecast across agents at time t, and the values of the forecasting variables at time t, respectively. Here, parameter λ indicates the frequency of households' updating forecasts.

To test whether the sticky information hypothesis holds for professional forecasters, we use a simple framework proposed by Coibion and Gorodnichenko (2015a). They propose a methodology to test the FIRE hypothesis by identifying whether a null hypothesis is rejected because of information rigidities. They document that pervasive evidence is consistent with the presence of information rigidities, using U.S. and international forecast data. The methodology proposed by Coibion and Gorodnichenko (2015a) relates ex-post forecast errors to ex-ante forecast revisions

[5] "Low Income" and "No Investments" groups are denoted as household annual income below 4 million yen and those who do not invest in stocks, respectively.

[6] k_t is computed as the average of forecasting variables during each survey wave.

[7] 'NonCollege Grad,' 'Low Income,' and 'No Investments' dummies take one when respondents have not graduated from college, their annual income is below 4 million yen, and they do not invest in stocks; otherwise zero.

[8] We do not report the tables showing the estimation results to save space.

on average. Equation (2) can be rewritten as

$$k_{t+h,t} - \mathbb{F}_t[k_{t+h,t}] = \frac{\lambda}{1-\lambda}(\mathbb{F}_t[k_{t+h,t}] - \mathbb{F}_{t-1}[k_{t+h,t}]) + \eta_{t+h,t}. \tag{3}$$

Here, $\eta_{t+h,t} \equiv k_{t+h,t} - \mathbb{E}_t[k_{t+h,t}]$ is the forecast error of agents, which cannot be predicted using information available in period t under FIRE. Thus, $\eta_{t+h,t}$ should be considered white noise. As a result, we can test the degree of sticky information by estimating Equation (3). There is another advantage in estimating Equation (3); it is a commonly used approach to test FIRE. Coibion and Gorodnichenko (2015a) shows that Equation (3) not only is a testing equation for FIRE but also uses theoretical mapping from economic theory to empirical tests. Once the coefficients in the estimating equations are obtained, the parameters λ and β can be calculated and interpreted; λ and β indicate the frequency of agents' updating forecasts and the weights on private signals. The difference between the classical tests of rationality and Equation (3) is the possibility of interpretations based on economic theory.

While Equation (3) is sufficiently simple to test the null, it requires at least two sequential forecasts over adjacent horizons at time t, because forecasts of the forecasting variable $k_{t+h,t}$ at time t and $t-1$ are needed. However, forecast data are not always rich. In fact, surveys that have "fixed-event" forecasts over multiple horizons are mainly from professional forecasters (e.g., consensus forecasts, surveys of professional forecasts). However, our unique survey of households allows us to estimate Equation (3). Using household survey data for forecasts of financial variables over multiple horizons, we estimate Equation (3).

4 Estimation results

Using the quarterly panel on the inflation expectations survey, we set h as 1 in Equation (3): the one-step ahead forecast errors are regressed on forecast revisions from $t-1$ to t. The estimation equation is the following:

$$k_{t+1,t} - \mathbb{F}^i_t[k_{t+1,t}] = \beta\left(\mathbb{F}^i_t[k_{t+1,t}] - \mathbb{F}^i_{t-1}[k_{t+1,t}]\right) + \eta^i_{t+1,t}, \tag{4}$$

where $\left(k_{t+1,t} - \mathbb{F}^i_t[k_{t+1,t}]\right)$ and $\left(\mathbb{F}^i_t[k_{t+1,t}] - \mathbb{F}^i_{t-1}[k_{t+1,t}]\right)$ are denoted as the one-step-ahead forecast error and forecast revision over the fixed-event from time $t-1$ to t by household i, respectively. Our interest is on the sign of the coefficient β. When β is significantly positive, it suggests information rigidities; households do not always update their information sets, as Coibion and Gorodnichenko (2015a) implies. When β is significantly negative, it suggests household overreaction to news from $t-1$ to t, as Bordalo et al. (2020) implies. As shown below, our estimation results demonstrate household overreaction.

Table 1 shows the estimation results from Equation (4) using the full sample. Specifications (1), and (4) show a significant negative sign of β. The evidence that β ranges from -0.4 to -0.3 support household overreaction rather than sticky adjustment to incoming news in revising their forecasts: Households overreact to news when they forecast both the stock index and foreign exchange rates. These results are robust when we use a subsample from those who frequently update their information sets, who invest in stocks, and who do not invest in stocks, respectively. In fact, the estimated values of β are stable: the signs are all negative and the values range from -0.4 to -0.3. This confirms household overreaction to news.

5 Asymmetric reaction to news

Incoming news may have heterogeneous impacts on expectation formation. A recent paper by Baqaee (2020) shows that households' inflation expectations are more responsive to inflationary news than to disinflationary news. The literature raises a question: Are households' reactions to optimistic and pessimistic news about financial variables, in particular, similar? Households may

be more responsive to "bad" news because their forecasts are "downwardly" skewed. If households are concerned about a sudden drop in the stock index and a sudden devaluation of local currency, this may entail overreaction to pessimistic news, which decreases the stock index and depreciates the local currency, more than to optimistic news.Bordalo et al. (2020) interpreted professional forecasters' overreactions as indicating representativeness *a la* Tversky and Kahneman (1974).

In order to examine the heterogeneous reactions of households to optimistic and pessimistic news, we split the data into positive and negative revisions and estimate Equation (4). Tables 1 supports the heterogeneous reactions to news. Pessimistic news about Nikkei 225 (USD/JPY) entails negative (positive) forecast revisions. Specifications (3) and (5) in Table 1 show that households are more responsive to pessimistic news than to optimistic news. In fact, the absolute values of β are larger than those of the benchmark cases in specifications (1), and (4). On the other hand, expansionary (appreciating) news about Nikkei 225 (USD/JPY) entails positive (negative) forecast revisions. Specifications (2) and (6) in Table 1 show the smaller (absolute) values of β, which range from -0.3 to -0.2. The tables consistently show that households care excessively about pessimistic news: they overreact more to devastating news that decreases the stock index and devalues the local currency than expansionary news that increases the stock index and appreciates the home currency. Thus, households appear to be more careful about "bad" news, which may entail a decrease in households' consumption levels, than about good news.

6 Conclusion

Using a large-scale survey of 50,000 households, we examine how households revise their expectations about financial variables. We find that households overreact to incoming news about the financial variables. In particular, households are more responsive to pessimistic shocks that may decrease their consumption levels than to optimistic news that may not. Overreaction in financial expectations by households is consistent with diagnostic expectations *la* Bordalo et al. (2020). Bordalo et al. (2020) interpret professional forecasters' overreaction as diagnostic expectations. They identify the deep parameter regarding the manner of updating information sets, which measures how professional forecasters overreact to news. We do not estimate the deep parameter because our survey is not long enough to estimate the data-generating process of survey data. The estimation issue is left for our future research.

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Table 1: Household Overreaction: Full Sample

	$k_{t+1,t} - \mathbb{F}^i_t[k_{t+1,t}] = \beta\left(\mathbb{F}^i_t[k_{t+1,t}] - \mathbb{F}^i_{t-1}[k_{t+1,t}]\right) + \mathbf{X}\gamma + \eta^i_{t+1,t}$					
	Nikkei 225			USD/JPY		
	(1) All	(2) FR ≥ 0	(3) FR < 0	(4) All	(5) FR≥ 0	(6) FR< 0
Forecast Revision (FR)	-0.380*	-0.281*	-0.620*	-0.378*	-0.497*	-0.248*
	(0.00248)	(0.00439)	(0.00901)	(0.00243)	(0.00646)	(0.00698)
Fixed Effect	YES	YES	YES	YES	YES	YES
Time Dummy	YES	YES	YES	YES	YES	YES
Observations	129,924	83,547	46,377	162,346	92,640	69,706
R-Squared	0.679	0.678	0.686	0.592	0.582	0.471
# of Respondents	20,809	19,107	15,749	25,889	22,813	21,305

Note: The forecasts of Nikkei 225 and USD/JPY above 50% and below -50% are trimmed. Standard errors in parentheses are clustered at individual levels, and * indicates 1% significance. Time and constant terms are included as the control variables.