Asset Price Forecasts under Quantitative and Qualitative Easing[*]

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Abstract

Using a unique survey, we identify monetary policy shocks at the household level. The survey allows us to examine whether unconventional monetary policies influence households' outlook about stock index in accordance with the literature about wealth effects. We find the positive association between an expansionary monetary policy shock and an upward revision of asset price forecasts. However, there is no clear evidence of the simple association when we use the subsample from the respondents who are less attentive to stock prices. Our findings support the theoretical prediction of behavioral macroeconomics under imperfect information: full attention of agents to news guarantees the effects of unconventional monetary policies while inattentiveness of agents may encumber them.

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rational inattention; QQE; stock price forecasts

1 Introduction

Using a unique survey, we identify monetary policy shocks at the household level. Our basic idea for the identification is to use forecast errors of (real) interest rates by each households as a monetary policy shock.[1] We also identify who collect information about financial variables by directly asking respondents to answer the frequency of updating their information sets. Using monetary policy shocks we identify, we examine whether unconventional monetary policies influences households' outlook about stock index in accordance with the literature about wealth effects. We find the positive association between an expansionary monetary policy shock and an upward revision of asset price forecasts. However, there are no evidence of the simple association when we use the subsample from those who never pay attention to the development of stock prices. Our findings support the theoretical prediction of behavioral macroeconomics under imperfect information: full attention of agents to news guarantees the effects of unconventional monetary policies while inattentiveness of agents may encumber them.

Our paper is related to two strands of the literature. First, our paper is related to studies identifying monetary policy shocks. How researchers identify monetary policy shocks and whether shocks have real effects are central questions for macroeconomists.[2] Contrary to the past literature using aggregate time-series data or high-frequency data, our identification strategy depends on households' survey data on forecasts of interest rates. The data allow us to identify a monetary policy shock for each respondent.[3] Second, our approach is based on previous studies about information rigidity and

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[1]As far as we know, this is the first paper to identify monetary policy shocks at the household level.

[2]A large body of literature identify (un)conventional monetary policy shocks from Romer and Romer (2004) to Mavroeidis (2021).

[3]To our best knowledge, this is the first paper to identify a monetary policy shock at the household level.

behavioral macroeconomics. The full information rational expectations (FIRE) hypothesis assumes that every economic entity makes decisions using the updated information set. However, the past studies strongly reject FIRE while they support the views from information rigidity and behavioral macroeconomics. In fact, economic agents are not always fully attentive to incoming news. Rather, they are inattentive; contrary to FIRE, even professional forecasters submit their forecasts based on the old information sets (Andrade and Le Bihan, 2013).[4] Our paper sheds light on attentiveness of households to financial variables and examines whether paying attention to development of financial variables matters for effectiveness of monetary policies. We find robust evidence of heterogeneous effects of monetary policies among households under information rigidity.

2 Transmission mechanism of monetary policies

2.1 Intertemporal substitution of consumption

We first present the theoretical framework to describe how monetary policies influence the growth rate of consumption. Suppose that the utility function is isoelastic. The objective of the consumer is:

$$\max \ E_0 \sum_{t=0}^{\infty} \beta^t \frac{c_{t+t}^{1-\gamma} - 1}{1-\gamma},$$

where β is denoted as a discount factor and γ^{-1} is the elasticity of intertemporal substitution. We assume that the consumer can borrow and save as much as needed at a real interest rate r. In this setting, the first order conditions lead to the Euler equation:

$$E_t \left[\left(\frac{c_{t+1}}{c_t} \right)^{-\gamma} \beta(1+r_t) \right] = 1. \tag{1}$$

Equation (1) simply indicates the theoretical predictions about the relationship between (real) interest rates and the growth rate of consumption. When a central bank decreases nominal interest rates, real interest rates decreases. In this case, households change the intertemporal allocation of consumption and saving; they save less and spend more today. The change in the intertemporal allocation entails greater consumption today. Even when nominal interest rates are almost zero, this mechanism can work by increasing inflation expectations via unconventional monetary policies. For example, a rise in the level of the inflation target may induce consumers to expect a higher inflation rate. Higher inflation expectations lead to a decrease in real interest rates, which entails greater consumption today. These are how a decrease in real interest rates by expansionary monetary policies induces greater consumption today.

2.2 Wealth effect

Another mechanism of monetary policies is a wealth effect. Monetary policies which decrease real interest rates entail a rise in asset prices. Asset price is determined by the current value of a stream of cash flows. Because a stream of cash flows is discounted by interest rates, an decrease in interest rates leads to an increase in the asset price. The negative association between interest rates and asset prices becomes a foundation for a wealth effect of monetary policies on consumption.

[4] Dupor et al. (2010) develop a model that integrates sticky prices and information and find that both types of rigidities are present in the U.S. data. Coibion and Gorodnichenko (2015) and Coibion and Gorodnichenko (2012) provide broader evidence of information rigidity.

3 Survey and households' forecasts

3.1 Questionnaire

This section summarizes the survey data of household's forecasts on stock price index and foreign exchange rates and shows basic statistics. We conduct 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 the financial variables in Japan.[5] These questions can directly reveal households' asset price forecasts and the manner of households' information collection. First, the survey allows us to examine how households update their information sets. We can test whether households update their information sets as the simple hypothesis of FIRE predicts. Second, the survey allows us to quantify households' asset price forecasts. Computing forecast errors on households' outlook about interest rates, we identify monetary policy surprises for each household. Third, the survey allows us to examine whether a monetary policy shock influences stock index forecasts over the short- and long-term horizons. If an unexpected monetary easing are associated with a "bullish" view of stock index, it may suggest that unconventional monetary policies induces an actual increase in asset prices.

4 How are households attentive to financial variables?

This section directly identifies the updating frequency of households' information on the financial variables. The full information rational expectations hypothesis assumes that every economic entity makes decisions using the updated information set. However, the past studies support the *sticky information* hypothesis, which maintains that economic agents do not always revise their information sets (**?**). In fact, they are inattentive; contrary to FIRE, even professional forecasters submit their forecasts based on the old information sets (Andrade and Le Bihan, 2013).

Table 1 shows the fraction of households that update their information sets on stock index (Nikkei 225). First, the figure shows that more than half of the households hardly collect information on Nikkei 225. While less than 50% of the households update their information sets, the rest of them never collect any information.[6] The existence of consumers who are inattentive to the development of fundamental values of economic variables casts doubt on the transmission of monetary policy through the management of expectations. In what follow, we examine whether the effect of a monetary policy shock is difference between attentive and inattentive agents to financial variables.

[5]We ask respondents to answer the following questions:

(1) Frequency of updating information on interest rates and stock prices.

  (a) "How often do you collect information on interest rates?"
  (b) "How often do you collect information on stock prices?"

(2) Outlook of the levels of interest rates and Nikkei 225 over shorter- and longer-horizons.

  (a) "What do you think will be the levels of interest rates over the next three- and six-month and three-year horizons when you borrow money? Provide figures (%) over each horizon."
  (b) "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."

Regarding Questions (1)-(a) and (1)-(b), respondents choose the most appropriate one from the following choices: (1) Almost every day, (2) Four or five times a week, (3) Twice or thrice a week, (4) Once a week, (5) One or more times a week, (6) Twice or thrice a month, (7) Once a month, (8) Once every two to three months, (9) Once in six months, (10) Once a year, (11) Less than once a year, and (12) Do not collect.

[6]From the perspective of theoretical view, the fact that not all households regularly update their information sets does not supports FIRE while it support information rigidities.

5 Identification strategy

Our identification strategy is to quantify monetary policy shocks by forecast errors of households' interest rate. We use (nominal) interest rate forecasts on 10-year ($\mathbb{F}_t^j[i_{t+k}]$) over the next k-month horizon by household j to identify a monetary policy shock.[7] Forecast errors of household j are defined as $i_t - \mathbb{F}_{t-1}^j[i_t]$ in the nominal terms. Using inflation expectations at time t over the next 10-year horizon from time t ($\mathbb{F}_t^j[\pi_t^{10year}]$), We also compute household j's forecast errors in the real terms using the survey on inflation expectations as $\left(i_t^{10year} - \mathbb{F}_t^j[\pi_t^{10year}]\right) - \left(\mathbb{F}_{t-1}^j[i_t] - \mathbb{F}_{t-1}^j[\pi_t^{10year}]\right)$ in the nominal and real terms, respectively.[8] In order to remove upward biases of heterogeneous risk-premium on interest rates and households' inflation expectations which the literature report, we regress these forecast errors on individual fixed effects:

$$r_t^{10year} - \mathbb{F}_{t-1}^j[r_t^{10year}] = c_j + \varepsilon_t^j. \tag{2}$$

We defined $\hat{\varepsilon}_t^j$ obtained from Equation (2) as a monetary policy shock for j.

We benefit from $\hat{\varepsilon}_t^j$ as a monetary policy shock. First, the identified shock is heterogeneous among households. It allows us to examine heterogeneous effects of a monetary policy shock. While heterogenous impacts of a monetary policy shock are examined by a Heterogeneous Agent New Keynesian (HANK) model, the approach based on heterogeneous shock among households are novel. Second, we use a much simpler method involving only linear regressions. We just compute forecast erros and use a fixed-effect estimation. Our approach does not depend on neither high-frequency data nor complicated econometric method. The simplicity to identify a monetary policy shock is the second merit. Third, our identification strategy is effective even under the unconventional-monetary-policy regime. The survey data allows us to alleviate the problem from the effective lower bound (ELB) of nominal interest rates: while nominal interest rates hardly become negative, forecasts on them can be become negative. Furthermore, forecasts on 10-year interest rates reflect how unconventional monetary policies such as forward guidance, inflation targeting, and asset purchase programs are valid to achieve the central bank's objectives.

To examine whether a monetary policy shock changes households' expectations, we regress the identified shock on households' outlook about stock index (Nikkei 225). This approach focus on the wealth effect in Section 2.2. The estimation equation is the following:

$$\mathbb{F}_t^j[q_{t+k}] = \beta\hat{\varepsilon}_t^j + \mathbf{X}\gamma + \eta_t^j, \tag{3}$$

where $\mathbb{F}_t^j[q_{t+k,t}]$ is denoted as the one step ahead forecasts on percent change in stock index by j and $\mathbf{X}$ includes control variables such as time dummies, individual fixed effects, and socioeconomic factors (gender dummy, age, educational attainments, and income levels). We set k to be one (1-quarter-ahead forecasts), two (2-quarter-ahead forecasts), and twelve (3-year-ahead forecasts).

Because an expansionary monetary policy shock leads to an increase in stock prices, households' outlook about the stock index becomes positive in response to the shock. Thus, the coefficient β is expected to be negative. However, if households are less attentive to financial markets and(or) changes in monetary policies, the shock is not correlated with bullish forecasts on the stock index.

[7] As Section 3 shows, our survey asks households to answer to the levels of interest rates on 10-year and stock index (Nikkei 225) over the next three- and six-month and three-year horizons. Stock index forecasts ($\mathbb{F}_t^j[q_{t+k}]$) are computed to be annualized percent changes based on the level forecasts on Nikkei 225 from each survey period.

[8] Note that $\mathbb{F}_t^j[\pi_t^{10year}]$ is not the same as $\mathbb{F}_{t-1}^j[\pi_t^{10year}]$: The former is inflation expectation from time t over the next 10-year of individual j which is formed based on an information set $\Omega_{j,t}$, while the latter is formed based on $\Omega_{j,t-1}$. Thus, $\mathbb{F}_t^j[\pi_t^{10year}]$ and $\mathbb{F}_{t-1}^j[\pi_t^{10year}]$ are "fixed-event" forecasts.

6 Estimation results

Table 2 shows the estimation results from Equation (3). The table shows that the coefficient $beta$s are all significantly negative when we use full-samples. The first and fourth columns using the full sample show the significantly negative sing of β. The significant association between an unexpected monetary easing and stock index forecasts suggests the causal effect of unconventional monetary policies on the bullish view of stock index. The results are robust when we use the subsample only from respondents who update their information sets about stock prices at least every one quarter. The second and fifth columns using the subsample show the significantly negative sing of β.

However, we do not find significant results when we use the subsample from respondents who never collect information about stock prices. The third and sixth columns using the subsample show the negative sign of β, but they are not significant. The results suggest that there are no effects of an expansionary monetary policy shock on the outlook about stock index for those who are not inattentive to stock prices. The evidence implies that the effects of a monetary policy shock are heterogeneous among households and attentiveness to monetary policies matters to achieve the central bank's objectives.

7 Conclusion

Using a unique survey, we identify monetary policy shocks at the household level. Using monetary policy shocks we identify, we examine whether unconventional monetary policies influence households' outlook about stock index in accordance with the literature about wealth effects. We find the positive association between an expansionary monetary policy shock and an upward revision of asset price forecasts. However, there is no clear evidence of the simple association when we use the subsample from the respondents who are less attentive to stock prices. Our findings support the theoretical prediction of behavioral macroeconomics under imperfect information: full attention of agents to news guarantees the effects of unconventional monetary policies while inattentiveness of agents may encumber them.

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Table 1: The fraction of households who update information sets about stock prices

	Information set updated			
	YES		NO	Total
	Once a week or more	less than once a week		
All	32%	17%	51%	100%
Female	17%	13%	70%	100%
Male	49%	17%	35%	100%
Age below 40	21%	15%	64%	100%
Age 40–59	34%	18%	47%	100%
Age 60–79	48%	16%	36%	100%
Non College Grad	25%	16%	59%	100%
College Grad	48%	16%	36%	100%
Low Income	26%	15%	59%	100%
High Income	41%	18%	41%	100%

Note: "Low Income" and "High Income" are denoted as households' annual income below 4 million yen and 7 million yen and above, respectively.

Table 2: Do monetary policy shock influence households' forecasts on Nikkei 225?

	$\mathbb{F}_t^j[q_{t+k}] = \beta\hat{\varepsilon}_t^j + \mathbf{X}\gamma + \eta_t^j$					
	over the next 3-year horizon $\mathbb{F}_t^j[q_{t+12}] = \beta\hat{\varepsilon}_t^j + \mathbf{X}\gamma + \eta_t^j$			over the next 6-month horizon $\mathbb{F}_t^j[q_{t+2}] = \beta\hat{\varepsilon}_t^j + \mathbf{X}\gamma + \eta_t^j$		
	(1)	(2)	(3)	(4)	(5)	(6)
β: MP shock ($\hat{\varepsilon}_t^j$)	−0.0773***	−0.0812**	−0.0964	−0.114*	−0.121*	−0.0721
	(0.0297)	(0.0322)	(0.0987)	(0.0633)	(0.0718)	(0.169)
Time Dummy	YES	YES	YES	YES	YES	YES
Information set updated	—	YES	NO	—	YES	NO
Observations	52,771	43,255	5,922	52,701	43,206	5,904
# of households	10,808	9,039	2,292	10,794	9,031	2,286

Note: The forecasts of Nikkei 225 above 50 and below -50 percent are trimmed. The standard errors between parentheses are clustered at the individual level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.