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Behavioral Biases in Firms' Growth Expectations

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Abstract

This paper provides evidence that firms exhibit behavioral biases in their growth expectations. Using firm-level survey data, we document that optimism and pessimism biases are generated by the business cycle, financial market conditions, and firm-specific factors including firms' past experiences. We also demonstrate that biases affect the real business decisions of firms. Firms' fixed investment and R&D spending are raised by optimism and hampered by pessimism. The above findings imply that behavioral biases generated by the firms can be an alternative mechanism on how macroeconomic and financial conditions affect their investment behavior in addition to the traditional optimization mechanism.

Keywords: Behavioral bias, Expectation, Firm, Investment, Optimism bias, Pessimism bias, Survey data

JEL Classification: D84, E03, E22

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1 Introduction

The expectations of economic agents is essential in describing the economy.[1] To elucidate the role of expectation in the macroeconomy, studying the agent who acts in the economy is more important than exploring the people who analyze the economy. However, the existing literature on expectation has mainly focused on that of professional forecasters. Even in exploring the expectations of household or firms, the weight is heavily placed on inflation expectation. There is clearly more work to be done on how economic agents envisage the growth of future economy and on how such expectations relate to real economic decisions.[2]

The other motivation of our paper is to extend the insights found in behavioral finance to describe the macroeconomy. Behavioral bias is the phenomenon in which people have a tendency to deviate from rational judgment due to a limited cognitive ability. In studies on financial markets, it is widely known that behavioral biases of investors exert a substantial effect on asset pricing and trading volumes where irrational judgments are made over a short-run horizon (e.g., Barberis and Thaler (2003); Shleifer (2000)). Meanwhile, the issue of whether such biases exert influence beyond the domain of the financial market has not received serious attention in the existing studies. A notable exception is the research of Korniotis and Kumar (2011) who argue that behavioral bias is pronounced in risk-sharing across households.

In this paper, we investigate whether firms have systematic behavioral biases in their growth expectations for the future economy and if biased expectations bring about a marked impact on their actual economic decisions. To the best of our knowledge, this is the first study to demonstrate these points in the existing literature. Specifically, we focus on "optimism" and "pessimism" defined as factors that push forecasts up or down systematically, regardless of whether they receive good news

[1] Recent studies underscore the role of expectation in business cycles (e.g., Kozlowski et al. (2015); Ilut and Schneider (2014)).

[2] We use the term "growth expectation" to describe an expectation on the growth of the economy in a broad context, which includes our empirical focus of firms' future industry demand forecast.

or bad news. We conjecture that firms interpret information differently (optimistically or pessimistically) depending on the firm's own state with respect to prevailing macroeconomic conditions and other firm-specific factors including past experiences. To identify what drives optimism and pessimism, we examine the relation of these factors and forecast errors defined as the difference of firms' forecasts and realized industry demand. We also explore whether such biases influence firms' decisions on fixed investment and research and development activities (hereafter R&D).

Our main findings in this paper are as follows. First, we find firms' expectations have systematic behavioral biases. We identify behavioral biases in the same way as Ehrbeck and Waldmann (1996), Amir and Ganzach (1998), and Ashiya (2003) study for professional forecasters, and provide evidence that firms also display bias in their expectations. Second, we further develop the analysis by exploring the factors affecting optimism and pessimism biases: business cycle; financial market conditions; and firm-specific factors including firms' past experiences. We find the systematic relation of forecast errors and these factors, and consequently confirm the violation of efficiency in firms' expectations. Such an association also exhibits asymmetry depending on whether firms receive good news or bad news. Our finding supports arguments developed in Malmendier and Nagel (2016) that focus on the role of past experiences in expectations. Third, we provide evidence that expectation and its behavioral biases matter in firms' actual business decisions. We find that firms' fixed investment and R&D are raised by optimism and suppressed by pessimism, even after controlling for the traditional determinants. The above findings imply that the behavioral bias of the firm manager can be an alternative explanation on how macroeconomic and financial conditions affect firm investment behavior in addition to the traditional optimization mechanism. Fourth, we derive the implications for the modest growth of investment in Japan. In recent years Japan has struggled with a slow investment growth, as other advanced economies experience a so-called "saving glut," where savings continue to exceed investments

in the corporate sector, especially after the global financial crisis. In our finding, firms that are profoundly affected by the past experience of financial difficulty are prone to be unduly pessimistic and consequently limit their investment.

Related literature Our paper is related to several strands of literature. First, our study is one on the expectation formation of firms in general. Due to the limited data availability, there are not a great number of studies regarding firms' expectations. Coibion et al. (2015) conduct a firm-level survey in New Zealand and examine a widespread dispersion of inflation expectation. Based on comprehensive empirical studies for economic agents including U.S. firms, Coibion and Gorodnichenko (2015) demonstrate that expectation formation can be explained by the imperfect information theory. The studies of imperfect information assume that economic agents do not incorporate all the available information due to exogenous barriers though they are rational, while in contrast, our analysis employs an alternative setting in which firms have limited cognitive ability to process information. Second, our paper is built upon studies of heterogeneity in forecasts. Souleles (2004) finds that households reveal systematic biases that are attributable to demographic factors. Davies and Lahiri (1995) find that forecast errors of macroeconomic variables are systematically affected by individual specific bias of professional forecaster. Amir and Ganzach (1998) and Ashiya (2003) find that professional forecasters have systematic biases that can be termed behavioral biases. We identify behavioral biases using the specification employed in the studies of professional forecasters, and further develop the analysis by pursuing the sources of such biases. Third, relevant works also include studies regarding the relation of firms' expectations and economic behavior. Gennaioli et al. (2016) find that expectations of firms' earning growth matter for their annual investment plans. Tanaka et al. (2017) argue that firms' forecasting ability matter for firms' performance. Bachmann and Elstner (2015) find that firms' expectations display systematic biases in forecasting their own production growth, and derive the welfare implication of their misforecasts. Our contribution

is to investigate the factors driving optimism and pessimism biases, and empirically examine how they influence the actual investing behavior of firms. Fourth, studies of overconfident managers are close in perspective to our paper in that they deal with the interaction between the psychological attitude and actual business decisions (e.g., Malmendier and Tate (2005, 2008); Malmendier et al. (2011)).[3] For example, Malmendier and Tate (2005) show that overconfidence of managers is related to overinvestment and high cash flow sensitivity of investment. Those studies view overconfidence as a reflection of an overestimation of the firm's future prospects and identify it using the timing of stock option exercises (revealed beliefs for future stock performance) and the number of articles referring to CEO as "confident" (perception of outsiders). In contrast to those studies, our paper has two differences. For one, our approach is distinct from others in the way of measuring firms' biases. We exploit firms' forecast errors of industry demand, which are direct measure of firms' confidence. Since forecasts are made for a common target for firms in the same industry, our results of biased expectations and investment capture a mechanism in which firms form expectations differently for the identical target, resulting in investment at various levels.[4] In addition, in contrast to existing studies emphasizing overconfidence alone, we find the significance of both optimism and pessimism in the business decisions, the latter of which could be termed "underconfidence."

The rest of the paper is organized as follows. Section 2 describes our survey data and basic facts. In Section 3, we set up our analytical framework for the determinants of biases and present empirical analyses. Section 4 examines the relation of expectation and firms' future planning. Section 5 shows empirical analysis on the relation of biases and firms' actual business decisions. Section 6 extends the discussions to derive an implication for the investment behavior of Japanese firms.

[3] Ben-David et al. (2013) argue that executives who miscalibrate about the stock market show a similar miscalibration concerning their own firms' prospects, and thus conduct more aggressive corporate strategies: investing more and using more debt financing.

[4] Using the forecasts made for a common target is another advantage of our approach, because they are not affected by how much private information each respondent in the survey has, unlike in the studies using the data of firm's future prospects of their own firm.

Section 7 concludes.

2 Survey data and basic facts

2.1 Survey data

Our survey data for firms' expectations are drawn from the "Annual Survey of Corporate Behavior" published by the Economic and Social Research Institute, Cabinet Office of Japan. The data we use are forecasts made during the period 1989 to 2015, a long horizon of more than 25 years, covering approximately 1000 firms each year, all of which are listed companies on the Japanese stock market. The survey is conducted between mid-December and mid-January every year. The data reflects the views of the corporate managers of each firm, though the position of respondent is not specified. The data are unbalanced panel as they contain the sample of all firms that responded to the survey at least once.

This survey provides us with abundant information on how firms envisage the future course of the economy. The advantages of this survey are the following. First, it provides the firm-level quantitative forecast data that are rarely used in the past studies. Bachmann and Elstner (2015) use confidential microdata from the "IFO Business Climate Survey" in Germany by converting qualitative data to quantitative data using certain assumptions. In this paper, we utilize the actual numbers reported by firms—a novel feature of our dataset. Kaihatsu and Shiraki (2016) analyze inflation expectation of firms using the same dataset. Second, since participation in the survey is voluntary and responses of each firm are not published, we suppose that firms do not have a strategic motive to report optimistic forecasts to convey a positive signal to investors. We can reasonably assume that the firms' forecasts purely reflect how they envisage the future economy.

The data we use in this section are forecasts for the real GDP growth rate and the real growth rate of industry demand in each industry which a firm belongs to.

We deal with the two forecasts for all firms to capture the overall features of this survey data in Section 2. We then switch the focus to the industry demand forecasts by manufacturing firm in Section 3. We use the industry demand forecasts, since we regard them as a better measure of firms' own business prospects compared to the GDP forecast. We deal only with manufacturing firms for reasons of realization data availability. When we plot and compare the industry demand forecasts and the actual industry GDP for each industry, we find industry GDP is not a good approximation for realization in all industries. We thus analyze manufacturing firms only where such approximation seems acceptable. The manufacturing firms represent almost 40 % of the total number of listed firms in Japan.

$F_{i,t}$ denotes the forecasting operator for firm i made at time t, and $A_{t,t+l}$ represents the average annual growth rate over l years of real GDP or industry demand. Forecasts are made for three horizons: the 1 year growth rate of the upcoming fiscal year $F_{i,t}A_{t,t+1}$; the average annual growth rate over the next 3 years $F_{i,t}A_{t,t+3}$; and the average annual growth rate over the next 5 years $F_{i,t}A_{t,t+5}$. We also use the data for firms' expectations of their own capital investment and employment. For these items, firms report average growth rate over the next 3 years, $F_{i,t}I_{i,t,t+3}$ and $F_{i,t}E_{i,t,t+3}$.

Our analysis in this paper mainly focuses on forecast errors and forecast revisions. The forecast error is the difference of forecast and realization, both of which are based on the annual growth rates from time $t+h-1$ to time $t+h$ where h denotes forecast horizon. The forecast error is defined as the forecast $F_{i,t}A_{t+h-1,t+h}$ minus its realization $A_{t+h-1,t+h}$, i.e., $FE_{i,t,t+h} = F_{i,t}A_{t+h-1,t+h} - A_{t+h-1,t+h}$. Positive forecast errors mean overestimation, while negative forecast errors mean underestimation. In this section, the realizations we use are the real GDP of the overall economy and that of the industry which each firm belongs to.

The forecast revision is how firms update their forecast made one year prior for the same target year. The forecast revision at time t for the target year $t+1$,

$FR_{i,t,t+1}$ is defined as the 1-year-ahead forecast made at time t minus the 2-year-ahead forecast made at time $t-1$, i.e., $FR_{i,t,t+1} = F_{i,t}A_{t,t+1} - F_{i,t-1}A_{t,t+1}$. In general, $FR_{i,t,t+h} = F_{i,t}A_{t+h-1,t+h} - F_{i,t-1}A_{t+h-1,t+h}$. As the 2-year-ahead forecast made at time $t-1$ is not available in the original survey data, we suppose that the combination of the average growth rate forecasts over the next 3 years $F_{i,t}A_{t,t+3}$ and the 1-year-ahead forecasts $F_{i,t}A_{t,t+1}$ contain the information of firms' 2-year-ahead forecasts. Using a relation of $(1+F_{i,t}A_{t,t+3})^3 = (1+F_{i,t}A_{t,t+1})(1+F_{i,t}A_{t+1,t+2})(1+F_{i,t}A_{t+2,t+3})$ and an assumption that the 2- and 3-year-ahead forecasts on the annual rate basis being equal, i.e., $F_{i,t}A_{t+1,t+2} = F_{i,t}A_{t+2,t+3}$, we calculate the 2-year-ahead forecast $F_{i,t}A_{t+1,t+2}$. We use a lagged $F_{i,t}A_{t+1,t+2}$ to obtain $F_{i,t-1}A_{t,t+1}$. Similarly, we presume that the forecasts on the average growth rate over the next 3 and 5 years give information for the annual growth rate forecasts of 4- and 5-year ahead. By assuming $F_{i,t}A_{t+3,t+4} = F_{i,t}A_{t+4,t+5}$, we calculate this and refer to it as "4-year-ahead forecast" hereafter. While this calculation is not ideal, it allows us to estimate how firms update their forecasts for the target period one year later, which leads us to gain important empirical findings.

In addition to the survey data, we use other data, all of which are explained in later sections. Finally, we explain outliers in this study. In the survey data and financial data, we define the data lying outside three standard errors of the variables' distribution as outliers and exclude them.

2.2 Some basic facts

This section illustrates the features of survey data.[5, 6] Figure 1 plots the time-series of mean forecasts for GDP and industry demand. To compare short and long horizon forecasts, we calculate the 1-year-ahead and 4-year-ahead forecasts on an annual growth rate basis. Figure 1 shows that forecasts broadly follow the actual data, but fail to reach the peak and bottom. The 1-year-ahead forecast is less volatile compared to its realizations, which results in persistent forecast errors. The 4-year-ahead forecast is flat and at a level higher than the 1-year-ahead forecast most of the time, suggesting that firms incorporate recent information only slightly in forming a long-run forecast, taking an optimistic view. The persistency in forecast errors suggests that there may be an impediment for firms forming full information rational forecasts, as discussed in Andrade and Le Bihan (2013).

Disagreement of forecasts, or in other words, the variance of forecasts is displayed in Figure 2. It shows substantial fluctuations in the face of large shocks like the global financial crisis in 2008. The forecasts gradually converge, taking two or three years to return to the level before the shock. Firms incorporate information slowly and at differing paces, resulting in an ongoing forecast dispersion. The disagreement in the GDP forecast is larger over a long-run horizon, which might provide evidence consistent with Patton and Timmermann (2010), who point out that economic agents tend to disagree over a long-run horizon, as they weigh their own priors. The disagreement of the industry demand forecasts is much larger than that of the GDP forecasts, reflecting the actual variation of industry demand. The disagreement of the 1- and 4-year ahead industry demand forecasts is almost at the

[5]For the realization data, we use data from the final release because earlier releases are not available for industry GDP, our main focus in this paper. We suppose that firms attempt to foresee the actual strength of the economy, which can be captured most precisely in the final release unlike professional forecasters who target the forecasts of the upcoming release.

[6]Realizations for the industry GDP is published only on a calendar year basis. To match the forecast data on a fiscal year basis, we convert the original industry GDP to the data on a quarterly basis using the index of shipment of manufacturing firms from industrial production issued by the Ministry of Economy, Trade and Industry of Japan, and take the average for the data on a fiscal year basis.

same level, suggesting that firm forecasts tend to disagree regardless of the time horizon as a result of various business conditions of firms.

Next, we focus on the properties of forecast errors, elaborating at the firm level. We compute the historical mean of forecast errors of the 1-year-ahead forecast for each firm. For each firm i responses are submitted N_i times throughout all survey periods, and we take the average of those forecasts, i.e., $\widehat{MF}^i = (1/N_i)\Sigma_{n_i=1}^{N_i} F_{i,t}^{n_i} A_{t,t+1}$, where $F_{i,t}^{n_i} A_{t,t+1}$ is the forecast at time t of firm i's n_ith response in the survey.

The distribution is shown in Figure 3. It seems nearly symmetric and the difference of the two extremes is almost 5–10%. The distribution for the industry demand forecasts is heavy-tailed compared to that of the GDP forecasts, as the former tend to disagree more as we saw earlier. Although firms face both positive and negative shocks over about 25 years, historical mean errors do not converge to zero. Some firms with positive values tend to forecast optimistically, and other firms with negative values are prone to forecast pessimistically.

Using the historical mean of forecast errors $\widehat{MF}^i$ for each firm for the GDP and industry demand forecasts, we describe the two way plot of these distributions in Figure 4. We find that the firms that have a tendency to overestimate their own industry demand are also likely to do so for GDP, although GDP is an identical target for all firms. Firms may reflect their own business conditions, which could include private information, in judging the overall economy.

The above evidence including persistent forecast errors, time-varying disagreement, and the correlation of forecast errors in GDP and industry demand altogether suggest that firms may not be able to process all the available information in forming their expectations. This motivates us to introduce behavioral biases in the following section. We attempt to investigate the factors affecting firms' biased expectations, which is as yet uninvestigated in the extant literature.

3 Determinants of optimism and pessimism

3.1 Empirical specification

We set up a specification to describe firms' forecasting behavior. Employing the specification studied in Ehrbeck and Waldmann (1996), Amir and Ganzach (1998), and Ashiya (2003), we introduce the following equation where firms reveal their behavioral biases in forecasting behavior.

$$FE_{i,t,t+h} = \beta FR_{i,t,t+h} + \Phi + \epsilon_{i,t},$$

where β represents overreaction and Φ signifies the degree of optimism.[7] We assume that when firms receive good (bad) news regarding industry demand, they revise their forecasts up (down). The positive correlation between forecast errors and forecast revisions thus accords with the phenomenon that firms' forecasts reflect good news and bad news so substantially that forecasts exceed realization.[8] When economic agents overreact (underreact) to information, β is positive (negative). An intercept Φ in the equation, on the other hand, means a tendency in a firm's expectation, regardless of the effect of forecast revisions. When Φ is positive, forecast errors are pushed up by a certain factor, regardless of whether firms receive good news or bad news, which is defined as optimism. When Φ is negative, it is evidence of pessimism. Based on the insights of Kandel and Zilberfarb (1999) and Lahiri and Sheng (2008) that argue different interpretation of information among agents, we conjecture that firms interpret information optimistically or pessimistically depending on their state with respect to macroeconomic, financial market, and firm-specific conditions, and that such variation in interpretation results in the biases of each firm.

[7] Our specification of the relationship between forecast errors and forecast revisions seems to be similar to that of the imperfect information model, but it is important to note that the equation derived under imperfect information is at the aggregate level, not at the individual level, as emphasized in Coibion and Gorodnichenko (2015).

[8] Amir and Ganzach (1998) argue that overreaction and optimism are attributed to representativeness and leniency heuristics.

In the following section, we focus on the factors driving optimism and pessimism by examining how forecast errors are related to factors attributed to the macroeconomic state and financial conditions. Specifically, we replace Φ with the dummy variables representing possible sources of the biases. They are denoted by Φ_t^M, $\Phi_{i,t}^H$, $\Phi_{i,t}^L$, $\Phi_{i,t}^{Exp}$, and $\Phi_{i,t}^{Past}$, each of which will be explained later. Our approach here can also be interpreted as a so-called efficiency test in expectations. Efficiency requires $\beta = 0$ and $\Phi = 0$, in which forecast errors are uncorrelated with any variable in an agent's information set at the time of forecast, as explained in Souleles (2004). Our result will show that such efficiency is not assured in firms' expectations.

3.2 Business cycles, news, and financial markets

In this section we examine whether macroeconomic conditions including the business cycle, recession news, and financial market conditions affect firms' optimism and pessimism. Our prediction is that firms become optimistic when they enjoy favorable business conditions including business cycle upturn and favorable financial market conditions. We first focus on the cyclicality of optimism. A dummy variable on the business cycle takes one when the annual GDP growth rate is positive and zero otherwise. We use the annual GDP growth rate in the third quarter, as it is the most recent information for firms at the time of forecast (mid-December each year). We also use another business cycle indicator, the number of newspaper articles reporting "recession." We do this by counting the number of articles reporting keywords of "recession," "business stagnation," and "business downturn" from the beginning of the year until mid-December.[9] The data are calculated from four major newspapers that are historically available.[10] Second, we use the stock price Nikkei 225 index and the foreign exchange rate of Japanese Yen against US dollar in mid-December.[11]

[9] We use articles reporting bad news only. Surprisingly, in our sample periods of about 25 years, 96% of the total news reporting "boom" or "recession" is news indicating "recession."

[10] They are *Asahi Shimbun*, *Mainichi Shimbun*, *Nihon Keizai Shimbun*, and *Yomiuri Shimbun*. The data are obtained from Nikkei Telecom.

[11] The increase in the foreign exchange rate indicates a depreciation of the Japanese Yen.

The estimation equation is as follows:

$$\begin{aligned} FE_{i,t,t+h} &= \beta^m FR_{i,t,t+h} + \gamma^m \Phi_t^M + \delta_i + \epsilon_{i,t}, \\ \text{where } \Phi_t^M &= 1 \text{ if } S_t > \overline{S}, \quad 0 \quad \text{otherwise.} \end{aligned}$$

Φ_t^M is a dummy variable representing macroeconomic state and financial variables that are common to all firms. It takes one when the each variable S_t (GDP growth, number of articles, stock price, and foreign exchange rate) minus its benchmark $\overline{S}$ is positive. The benchmark is zero for GDP growth and the historical mean for the other variables.[12] We identify optimism and pessimism from positive and negative signs of γ^m. δ_i is the firm-level fixed effect. We use Driscoll-Kraay standard errors throughout the paper to address serial correlation, heteroskedasticity, and cross-sectional dependence, all of which are often observed in long panel data where economic agents are subject to common shocks. We do not incorporate a time dummy in this subsection because it is not compatible with the dummy variables representing macroeconomic state.

Table 1 shows the results. All four variables are significant and sign conditions conform to our prediction. Optimism occurs when a positive growth rate is observed.[13] When news of recession is reported frequently, firms have a pessimism bias. Firms become optimistic when their stock price is higher and when the Japanese Yen is lower than the historical average against the US Dollar. The association of a weaker Japanese Yen and a positive attitude toward the economy reflects the reality where a weaker Japanese Yen is favorable for the exporting firms that constitute the majority of Japanese manufacturing firms. Table 2 describes the results using

[12] Japan's stock price experienced a sharp drop in the beginning of the 1990s due to the burst of the bubble economy. Considering this effect, we use samples from 1993 onward when analyzing the effect of stock price.

[13] Calculating the dummy variable for GDP growth, we confirm that the results remain unchanged when using the real-time data (the result is not reported here). We use the data provided by Yasuyuki Komaki (`http://www.eco.nihon-u.ac.jp/eco_kyouin/komaki/RealTimeData-091121.html`) .

the 4-year-ahead forecasts. The macroeconomic and financial market variables are not significant, indicating that business cycle and financial fluctuations affect only short-run expectation.

Table 1 also reports the positive coefficients of forecast revisions that represent overreaction bias. Overreaction bias is found in analysts' forecasts of earnings changes in many studies (e.g., De Bondt and Thaler (1990); Easterwood and Nutt (1999)), and we confirm such bias exists also for firms. In Appendix B, we examine if the volatility of economy affects overreaction.

3.3 Firm-specific factors

We examine whether optimism and pessimism biases are generated by firm-specific factors. Our hypothesis is that when firms form their expectations for future industry growth, they are highly influenced by their own conditions. Our approach in exploring these biases is similar to Davies and Lahiri (1995) and Souleles (2004), both of whom find systematic biases that are attributed to heterogeneity of economic agents. We deal with profit over asset, debt over equity, exports, and firms' past experiences.[14] Specifically, we suppose that current earnings over asset and debt over equity could generate biases when they exceed a certain threshold level. To capture the financial conditions of firms, we match the survey data with the "Financial data of Listed Firms" issued by the Development Bank of Japan for each firm. We then compute quartiles of each variable for each year, and define upper and lower state dummies $\Phi_{i,t}^{H}$ and $\Phi_{i,t}^{L}$ that take one when the value of each variable $S_{i,t}$ is above the third quartile S_t^{q3} or below the first quartile S_t^{q1}, respectively. We also use the dummy $\Phi_{i,t}^{Exp}$ to identify exporting firms so as to examine whether overseas business exposure generates firms' systematic biases.[15] In addition, we test the hypothesis that past experience matter in forming expectations, considering the

[14] Firms' financial condition data used in this subsection is on a consolidated basis.

[15] Exporting firms are required to make their forecasts of a break-even foreign exchange rate, and we use this response as an identifier of exporting firm.

suggestions by Malmendier and Nagel (2011, 2016) who show that inflation expectations of households and risk attitudes of consumers are substantially affected by their past "experience." We specifically test whether having "experience of deficit" and "experience of liquidity shortage" makes firms pessimistic by adding dummy variables $\Phi_{i,t}^{Past}$ for firms with experience of current profit being negative or with a liquid liability ratio larger than two in the past 5 years.[16]

$$\begin{aligned} FE_{i,t,t+h} = \beta^{\Phi} FR_{i,t,t+h} \quad &+ \quad \gamma^{H}\Phi_{i,t}^{H} + \gamma^{L}\Phi_{i,t}^{L} + \gamma^{E}\Phi_{i,t}^{Exp} + \gamma^{P}\Phi_{i,t}^{Past} + \delta_i + \delta_k + \delta_t + \epsilon_{i,t}, \\ \text{where } \Phi_{i,t}^{H} \quad &= \quad 1 \text{ if } S_{i,t} > S_t^{q3}, \quad 0 \quad \text{otherwise}, \\ \text{and } \Phi_{i,t}^{L} \quad &= \quad 1 \text{ if } S_{i,t} < S_t^{q1}, \quad 0 \quad \text{otherwise}. \end{aligned}$$

We control for fixed effects of firm δ_i, firm size δ_k, and year δ_t.[17] We estimate the equation for two separate samples, considering asymmetry of expectation formation found in Amir and Ganzach (1998) and Ashiya (2003)—when forecast revisions are positive and negative.[18]

Table 3-A and 3-B lay out the results for the 1-year-ahead forecast. Table 3-A presents the result for the sample with positive forecast revisions and Table 3-B for negative forecast revisions, respectively. Highly profitable firms tend to be optimistic, which is a result observed consistently in all cases. Even when firms revising the forecast downward, profitability supports their confidence. Experience of deficit exhibits a negative sign, but seems to have less explanatory power because it does not remain significant when controlling for the current earnings. Experience of liquidity shortage, on the other hand, generates strong pessimism in the upward

[16] Liquidity ratio is defined here as the proportion of liquid liability over liquid asset. When the liquid liability ratio is more than two, more than half of liquid liability cannot be paid off easily when firms make the repayment.

[17] We introduce time dummies to control for cross-sectional dependence due to perfectly uniform aggregate shocks, and also use robust standard errors to cross-sectional correlation that are not identical for every pair of cross-sectional units. The latter consideration is helpful to address the concern of cross-sectional dependence observed at certain categories.

[18] We undertake the same exercise for macroeconomic variables (not reported here), and find that business cycle, stock price, and foreign exchange rate are significant in both forecast revision signs. News on the business cycle is significant only in negative forecast revisions.

forecast revisions. The results for debt ratio and exporting firms yield no specific evidence. Not controlling for size of firms does not alter the results and this implies that firm size does not generate a specific tendency.[19]

Table 4 describes the results for the 4-year-ahead forecast. The state of profit affects the biases even in the long run, implying that firms at happy moments are likely to be lured into optimism both in short and long horizons. High leveraged firms tend to be optimistic in the long run when forecast revisions are positive. It may reflect the fact that there are optimistic firms that attempt to expand business proactively by increasing debt, especially when enjoying favorable business conditions. Regarding past experiences, as shown in the results for the 1-year-ahead forecast, the experience of a liquidity shortage makes firms pessimistic even in long-run forecasts when they revise their forecasts upward.

Some of our results accord with the findings in the existing studies. We find that firms' expectation exhibit asymmetry, which is in line with the findings of Amir and Ganzach (1998) and Ashiya (2003). We show that biases affected by firm-specific factors are pronounced, especially when they revise their forecasts up. For example, low profit and experience of liquidity shortage generate a pessimistic tendency when revising forecasts upward. This implies that firms may be prone to blurred vision upon receiving good news but seem to have clearer vision in the case of bad news. The association of optimism and leverage is also a finding consistent with Bachmann and Elstner (2015) who find that highly-leveraged firms tend to be optimistic. Firm-specific factors generate the biases both in the 1- and 4-year-ahead forecasts, while macroeconomic variables only affect the biases in the 1-year-ahead forecast. This is broadly in line with with Patton and Timmermann (2010) who point out that economic agents tend to disagree on a long-run horizon as they weigh their own priors.

[19] Size of firms is controlled using the dummy variable based on the classification by capital size. They are grouped in four categories: capital less than 1 billion yen; 1 to 5 billion yen; 5 to 10 billion yen; 10 billion yen or more.

There is however, a caveat in the interpretation of our results. In the survey, firms are asked to report the forecasts on "their own industry demand" based on their own categorization. In such a case, bias can be attributed to the different focus of respondents. We thus attempt to alleviate this effect by including firm-level fixed effect that captures firm-specific properties. We suppose that this caveat does not substantially affect our main findings, which illustrate highly systematic relations. For robustness checks, Appendix C provides results corroborating our main results.

4 Expectations and firms' future planning

The results of the above section suggest that firms' expectations for future demand are biased. Before assessing the relations between expectation bias and firm's behavior, we examine if expectation influences the future plans of firms. Although it is well known that expectation for future demand is an essential element in making future plans, the relation of expectation and investment or hiring decisions is not clearly modeled in the optimization framework. A notable exception is Gennaioli et al. (2016) who derives the relation between expectation of future earnings and investment based on the optimizing behavior of firm. They find the significance of expectation is robust to controlling for the factors suggested by alternative theories of investment. Following their framework, here we assess whether expectation of future demand is significant in explaining investment and employment plans, after controlling for the traditional variables determining investment and employment.

We use the data of firm's future plans for investment and employment. The survey asks the average annual growth rate of investment and employment over the next 3 years. We regress firms' investment plans $F_{i,t}I_{i,t,t+3}$ and employment plans $F_{i,t}E_{i,t,t+3}$ on their expectations for future industry demand: the 1-year-ahead forecast $F_{i,t}A_{t,t+1}$ and the 3-year-ahead forecast $F_{i,t}A_{t+2,t+3}$.

We control for the variables we assume candidate determinants. For investment

plans, they are investment opportunities, liquidity constraint, debt ratio, and uncertainty.[20] The variables we use are Tobin's average Q, cash flow over asset, debt over asset, and volatility of firm's profit growth of the past 5 years.[21] The lagged change in capital stock is also included following the specification derived in Gennaioli et al. (2016). For employment plans, we use wage growth and the variable representing slack in labor market, both of which seem to be relevant for future hiring or firing decisions.

The equations we estimate are

$$\begin{aligned} F_{i,t}I_{i,t,t+3} &= \gamma_I F_{i,t}A_{t+h-1,t+h} + \lambda_1 TQ_{i,t} + \lambda_2 CFA_{i,t} + \lambda_3 DA_{i,t} \\ &+ \lambda_4 VOL_{i,t} + \lambda_5 ST_{i,t-1} + \delta_i + \delta_k + \delta_t + \epsilon_{i,t}, \end{aligned}$$

where $TQ_{i,t}$, $CFA_{i,t}$, $DA_{i,t}$, $VOL_{i,t}$, and $ST_{i,t-1}$ denote Tobin's average Q, cash flow over asset, debt over asset, volatility of profit growth measured in the past 5 years, and lagged difference in capital stock; and

$$F_{i,t}E_{i,t,t+3} = \gamma_E F_{i,t}A_{t+h-1,t+h} + \omega_1 WG_{i,t} + \omega_2 ES_{j,t} + \delta_i + \delta_k + \delta_t + \epsilon_{i,t},$$

where $WG_{i,t}$ and $ES_{j,t}$ denote growth of average wage per employee at firm i and employment index representing labor market slackness at industry j that firm i belongs to.[22]

Table 5 exhibits the results for investment. We find that expectation for future demand is still significant in explaining investment plans, after controlling for traditional determinants. It is significant both when we use the 1-year-ahead and

[20] The firms' financial variables are drawn from the "Financial Data of Listed Firms." As long-time series data of investment are not available on a consolidated basis, we use nonconsolidated data hereafter for consistency.

[21] We use average Q, defined as TQ=(Market value of firm equity + Long-term debt + Debt in current liability)/Total asset. Market value of firm equity is calculated using the data from the Nikkei Needs Financial Quest. We use the asset data as of the end of the previous period.

[22] We use the data for employment conditions in each industry to capture labor market slackness. The data are drawn from the "Short-term Economic Survey of Enterprises (TANKAN)" issued by the Bank of Japan.

3-year-ahead forecasts of future demand. Table 6 shows that expectation for future demand also counts for employment plans over the next 3 years.[23] Gennaioli et al. (2016) discuss that the explanatory power of expectation in investment suggests that the problem may be with the stock market based measures of Tobin's Q. They argue that a measure of investment opportunities based on actual expectations of corporate managers does much better in explaining investment.[24] Our result can be interpreted as evidence to support this view.

Given the findings so far, our next interest is whether biased expectation prevents firms' optimal business decisions, which we will explore in the following section.

5 Optimism/pessimism and investment decision

We investigate whether optimism and pessimism affect the actual investment behavior of firms. Since the results in the previous section document that various factors concurrently affect the biases, here we construct measures to reflect the overall tendency of firms' optimism and pessimism. We use two specifications to compute such measures. First, considering that systematic biases in expectations are often assumed to be time-invariant and individual-specific in past studies (e.g., Davies and Lahiri (1995); Souleles (2004)), we construct a measure describing firm-specific biases. Second, we calculate a measure representing biases for each firm and each period, which we call state-dependent biases.

Firm-specific biases, investment, and R&D

We suppose that the larger historical average of regression errors $\widehat{MRE}^i = (1/N_i)\Sigma_{n_i=1}^{N_i}\epsilon_{i,t}^{n_i}$ are, the more optimistic the firms are. The errors are calculated as $\epsilon_{i,t}^{n_i} = FE_{i,t,t+1} - \beta FR_{i,t,t+1}$.[25] We define optimism and pessimism bias using the

[23] Due to the data availability of employment plans, our estimation uses data from 1993 onwards.

[24] Erickson and Whited (2000) also shed light on the importance of the measurement error of Tobin's marginal Q. They demonstrate that the Q theory of investment's disappointing performance is due to error in measuring marginal Q.

[25] We use an estimated value of β gained from the regression of forecast errors on forecast revisions

quartile threshold of $\widehat{MRE}^i$ calculated in total sample periods. Optimism dummy Opt_i takes one when firm i's $\widehat{MRE}^i$ is higher than the third quartile of its distribution, and pessimism dummy Pes_i is one when it is lower than the first quartile accordingly. The data we use as dependent variable are real investment over capital stock.[26] It is calculated using the perpetual inventory method, which is a conventional method in the existing literature.[27] The estimation equation is as follows:

$$\begin{aligned}\frac{I_{i,t}}{K_{i,t-1}} &= \gamma_o^I Opt_i + \gamma_p^I Pes_i + \kappa_1 TQ_{i,t} + \kappa_2 CFA_{i,t} \\ &+ \kappa_3 DA_{i,t} + \kappa_4 VOL_{i,t} + \delta_k + \delta_t + \epsilon_{i,t},\end{aligned}$$

where $I_{i,t}/K_{i,t-1}$ denote investment over capital stock in the previous period. For endogeneity concern, we check the results using lagged values of explanatory variables and confirm that the results remain unchanged (not reported here). We include time dummies δ_t, but not the firm-level fixed effect, because the optimism and pessimism dummies defined for each firm are not compatible with the firm-level fixed effect. Instead, we include δ_k, the fixed effect to control for firm size.

As is evident from Table 7, optimism and pessimism biases significantly influence firm investment. Optimistic firms, on one hand, invest more than firms without biases, and pessimistic firms, on the other, invest less than firms without biases. These results support our hypothesis that behavioral biases affect firms' investing behavior. Our finding is consistent with the past studies documenting the relation of overconfidence and corporate policies (e.g., Malmendier and Tate (2005, 2008); Malmendier et al. (2011)). They regard overconfidence as an element reflecting

only.

[26] Investment hereafter refers to investment in physical assets such as machinery, vehicles, buildings, and constructions. It excludes land purchasing expenses, financial assets, software, and research and development expenses. Due to the data availability, the data are on a nonconsolidated basis.

[27] We calculate real investment and capital stock in the following way. We first divide the nominal gross investment by the corresponding price indices, and apply the perpetual inventory method to three types of capital stocks: buildings and structures; machinery and equipment; and vessels and vehicles, following Hayashi and Inoue (1991). The price indices are drawn from the "Producer Price Index" issued by the Bank of Japan.

the managers' bright prospects of their own firm, and identify it using the timing of stock option exercises (revealed beliefs for future stock performance) and the number of articles referring to CEO as "confident" (perception of outsiders). In contrast, we identify behavioral biases utilizing firms' forecast errors of industry demand, which are direct measure of firms' confidence. Since forecasts are made for a common target for firms in the same industry, our results of biased expectation and investment capture a mechanism in which firms form expectations differently for an identical target, resulting in investment at various levels.

Our evidence also differs from others in that we underscore the role of pessimism in addition to optimism, whereas the existing studies focus on overconfidence, an upward expectation alone.

Next, we test whether optimism and pessimism bias exert a significant impact on firm R&D spending. We consider other candidate factors affecting R&D, while they are not well established in the existing literature compared to those of fixed investment.

$$\begin{aligned}\frac{R\&D_{i,t}}{W_{i,t-1}} &= \gamma_o^R Opt_i + \gamma_p^R Pes_i + \tau_1 TQ_{i,t} + \tau_2 CFA_{i,t} + \tau_3 SA_{i,t} \\ &+ \tau_4 DA_{i,t} + \tau_5 VOL_{i,t} + \tau_6 OV_{i,t} + \tau_7 AW_{i,t} + \delta_k + \delta_t + \epsilon_{i,t},\end{aligned}$$

where $R\&D_{i,t}/W_{i,t-1}$, $SA_{i,t}$, $OV_{i,t}$ and $AW_{i,t}$ are R&D expenditures over asset in the previous period, sales over asset, overseas production ratio, and average wage per employee. The other variables are defined above.

As R&D investment is a part of overall investment, we capture investment opportunities by Tobin's Q. Sales is also a commonly used factor to reflect such opportunities. R&D investment has some characteristics that make it different from ordinary investment. For example, Hall and Lerner (2010) argue that since knowledge is the key resource required for invention, and the return of R&D is difficult to measure, access to external finance is taken as an important factor in R&D. We

include debt over asset to control for such an external financing factor. In addition, we consider other two variables: the overseas production ratio and the level of wage per employee, representing good business networks and human resources.[28] This practice reflects the insights of Lai et al. (2015) who discuss that the determinants vary across three Asian countries (Japan, South Korea, and Taiwan) and find that firms with better business and human resources engage in more R&D activities, especially in Japan. Due to the data availability of R&D expenditure, our estimation for the R&D equation uses data from 1999 onward.

Table 8 lays out the results. R&D activity is boosted by optimism and hampered by pessimism, as we find in the investment equation. Our findings suggest that greater confidence on the future economy could generate greater innovation and consequently result in productivity growth, while they might be suboptimal. The association of optimism and active R&D spending accords with the findings in Hirshleifer et al. (2012), though they only deal with overconfidence, which is expressed as an upward expectation of their own firm.[29]

State-dependent biases, investment, and R&D

In the former specification, we suppose that optimism and pessimism are attributed to firm-specific characters that are time-invariant. Here we use an alternative specification of time-variant optimism and pessimism and explore again their impact on fixed investment and R&D.

We suppose that the larger the regression errors $\epsilon_{i,t} = FE_{i,t,t+1} - \beta FR_{i,t,t+1}$, the more optimistic firms are. Optimism dummy $Opt_{i,t}$ takes one when firm i's $\epsilon_{i,t}$ is higher than the third quartile of its distribution each year, and pessimism dummy $Pes_{i,t}$ is one when it is lower than the first quartile accordingly. Both are defined for time t when forecasts are made.

[28] The overseas production ratio is obtained from the survey data.

[29] The above results could also be associated with the so-called free cash problem put forward by Jensen (1986)—where managers of firms have an incentive to make their own firm grow beyond optimal size under asymmetric information between corporate insiders and the capital market.

The estimation equations for investment and R&D are as follows:

$$\begin{aligned}
\frac{I_{i,t}}{K_{i,t-1}} &= \gamma_o^I Opt_{i,t} + \gamma_p^I Pes_{i,t} + \kappa_1 TQ_{i,t} + \kappa_2 CFA_{i,t} \\
&+ \kappa_3 DA_{i,t} + \kappa_4 VOL_{i,t} + \delta_i + \delta_k + \delta_t + \epsilon_{i,t}, \qquad (1) \\
\frac{R\&D_{i,t}}{W_{i,t-1}} &= \gamma_o^R Opt_{i,t} + \gamma_p^R Pes_{i,t} + \tau_1 TQ_{i,t} + \tau_2 CFA_{i,t} + \tau_3 SA_{i,t} \\
&+ \tau_4 DA_{i,t} + \tau_5 VOL_{i,t} + \tau_6 OV_{i,t} + \tau_7 AW_{i,t} + \delta_i + \delta_k + \delta_t + \epsilon_{i,t}.
\end{aligned}$$

The results are reported in Tables 9 and 10. When the biases are assumed to be state-dependent, pessimism bias is significantly negative only in the investment equation, while optimism bias is significantly positive only in the R&D equation. These results are maintained when controlling for firm-level fixed effect. In the prior results of firm-specific biases, both optimism and pessimism exert a significant impact on fixed investment and R&D. Combining these results, they suggest that when firms become pessimistic only temporarily, they curtail fixed investment, while "pessimistic firms"—the firms with time-invariant pessimism bias—suppress both fixed investment and R&D spending. Contrasting results are reported in optimism. When firms become optimistic, they only increase R&D spending, and "optimistic firms" expand investment in addition to R&D.

Our result of the pessimism bias curbing investment can be related to findings that have been explored in the context of investment and uncertainty. Investment under uncertainty is well studied in the existing literature. In a recent work, Bloom et al. (2012) demonstrate that uncertainty for firms is heightened during recessions, and also show that increased uncertainty leads to significant falls in hiring, investment, and output. Considering our findings in Section 3—that pessimism bias is triggered by downturn in business cycles—our results here suggest that firms' pessimism in expectations provides an alternative explanation to describe dampened investment under unfavorable and uncertain economic conditions.

The other finding here is that R&D spending is particularly responsive to op-

timism. Existing studies have argued that firms tend to concentrate R&D during booms. Shleifer (1986) argues that firms take advantage of high aggregate demand by innovating simultaneously during booms, and Barlevy (2007) argues that firms actively engage in R&D activities to chase the short-term benefit of innovation when economic conditions improve. Our empirical findings that R&D is promoted by firms' optimism bias for the future economy provides a different perspective on why R&D spending expands in booms.

6 Discussion: Implication for Japan's slow investment growth

Finally, we derive an implication for the recent modest investment growth in Japan from our findings in this paper. As shown in Figure 5, Japanese firms have been cautious in investment decisions despite posting record high profit in recent years. Kato and Kawamoto (2016) examine the factors underlying this phenomenon.[30] Our analysis can propose an alternative explanation. In previous sections, we find the factors affecting the behavioral biases, and the experience of liquidity shortage among them in particular prevent firms from forming positive long-run expectations. We also provide evidence that firms' growth expectations affect their investing behavior. Both results together imply that the firms highly affected by the experience of financing difficulty are prone to be unduly pessimistic and restrain their investment and R&D. Hayakawa (2016) provides a similar argument. He claims that Japanese firms with experiences of liquidity shortage tend to exhibit inactive investing behavior because they have been caught in the situation which he terms "learned pessimism."

[30] Not only Japan but other advanced economies share a similar experience of the so-called corporate "saving glut"—the situation in which savings continue to exceed investment in the corporate sector especially in the period following the global financial crisis (Gruber and Kamin (2015)). Some empirical studies find that firms' reduced investment and hoarded profits are due to their caution toward future uncertainty after such financial turbulence (Banerjee et al. (2015)).

Figure 6 describes the diffusion index of funding condition reported by firms.[31] In the late 1990s and late 2000s Japanese firms were faced with a tightening of funds. Following the intuition put forward by Hayakawa (2016), we examine whether firms that experienced a liquidity shortage in 1998 and 2008 suppressed investment. We regress investment over capital stock on the dummies representing whether or not they experienced severe liquidity shortage in the face of financial crisis in 1998 and in 2008 with other relevant variables controlled. The severe liquidity shortage is defined as the top 5% of the distribution of changes in the liquid liability ratio from two years before each crisis. The estimation is conducted using a sample from 2010 onward.

Table 11 presents the result. Experience of severe liquidity shortage in 1998 and 2008 negatively affect investment. Considering we use data from 2010 onward, our result demonstrates that such an experience has a long-lasting impact on firms' decisions around investment.[32]

What remedy will break the curse of firm pessimism? If firms hoard their cash as a result of unreasonably pessimistic growth expectations, eliminating the firm's bias could optimize their behavior. Making firms aware of their bias is one measure to release them from their pessimistic expectations. The results of this paper could serve this role. Preventing situations which generate pessimistic memories from occurring in the first place is also a potential remedy. When firms are biased toward pessimism, the optimal level of investment and efficient allocation of resources can be achieved by curbing this bias.

[31] The data are drawn from the "Short-term Economic Survey of Enterprises (TANKAN)" issued by the Bank of Japan.

[32] According to our calculation, the investment over capital stock of the firms with an experience of severe liquidity shortage is approximately 50% lower than those without such experience on average.

7 Conclusion

This paper provides evidence that firms exhibit behavioral biases in their growth expectations. We especially focus on optimism and pessimism defined as factors that push forecasts up or down systematically, regardless of whether they receive good news or bad news. We also explore the factors affecting such biases. We find that when firms face favorable business conditions including business cycle upturns, rises in stock price, depreciation of domestic currency, they exhibit optimism bias. Pessimistic news on the business cycle turns firms' expectations toward pessimism. Firm-specific factors also systematically influence their expectations. When firms enjoy higher profit, they tend to be optimistic, and the past memory of severe liquidity shortage works as an impediment to upward expectations. Altogether, these findings imply that firms have restricted vision, or in other words, are heavily influenced by the situations they face. Our results also imply the failure of efficiency in firms' expectations, as they show the systematic relation of forecast errors and variables in firms' available information set at the time of forecast. These findings provide new evidence on how firms form their expectations, which to this point has not been well studied in the existing literature. Given the biases found in the firms' expectations, we also demonstrate that expectations matter for firms' planning, and the optimism and pessimism biases affect their actual investing behavior. We find that optimistic (pessimistic) firms tend to invest more (less) than the firms without the biases. We also show that R&D is raised by optimism and hampered by pessimism. In the context of improving efficiency in investment, firms need to correct their misforecasts. Making firms aware of these biases can release them from the restrictions imposed by the biases. The result of this paper could serve this role. For the purpose of enhancing growth, policies generating optimism could lead firms to invest more, which could result in an expansion of the economy. Optimism also increases R&D expenditure and consequently could promote innovation and productivity growth. Our findings in this paper therefore imply that practices working on

the optimism and pessimism biases could trigger change in firm behavior and the overall economy.

Appendix

A Biases, firm size, and year

Appendix Table 1 presents the estimation results where forecast errors are regressed on forecast revisions and dummy variables for firm size and separate periods of time. The size of firms is captured by capital size classifications, grouped in four categories: capital less than 1 billion yen (Size of capital I); 1 to 5 billion yen (Size of capital II); 5 to 10 billion yen (Size of capital III); and 10 billion yen or more (Size of capital IV). Size of capital I is omitted in the estimation. The result shows that larger firms tend to be optimistic for both the 1- and 4-year-ahead forecasts. We also check if the levels of firms' biases change after 1998 or 2000. We cannot identify a statistical difference between the two sample periods no matter when the threshold is set. When we do the same exercise for forecasts for the GDP growth rate, we confirm that the dummy for samples from 1998 onward is significantly negative (not reported here). This can be attributed to the phenomenon that Japanese firms, especially in banking sector, faced a severe credit crunch in 1998 that triggered a prolonged recession.

B Overreaction bias and its state dependency

In Appendix B, we tentatively change the assumption of constant β. Overreaction is generally interpreted as an overweighting of signals compared to prior beliefs (Daniel et al. (1998)).

We explore whether economic volatility affects the degree of overreaction. When economic agents are more uncertain in signals, they put less weight on them and incorporate less information from newly arrived signals.

To measure the volatility, we calculate the historical volatility of monthly business cycle indicators for each year, the coincident index of business conditions drawn from the "Indexes of Business Conditions" issued by the Cabinet Office of Japan, and convert it to the dummy variable representing one when volatility is above the historical average. The result is shown in Appendix Table 2. The interaction terms of volatility and forecast revisions are significantly negative, suggesting that overreaction bias diminishes when the volatility of the economy increases. Under the volatile environment where firms are uncertain about the signal they receive, they rely on their own prior beliefs more and give new information less weight. However, in the 4-year-ahead forecasts, the effect of volatility is no longer negative, and it exhibits positive sign in two cases, as shown in Appendix Table 3. While this result somewhat contradicts the prediction of volatility and the precision of signal, it is still reasonable that firms in the face of large shocks tend to incorporate more information from signals to form their long-horizon forecasts than short-horizon forecasts, when they consider large shocks to be persistent.

C Robustness checks

We confirm robustness of the results in Section 3.3, by using alternative variables for profit ratio and debt ratio. We use operating profit over sales and long-term debt over assets instead of current earnings over assets and debt over equity. Appendix Tables 4 and 5 show the results. The results for profit ratio are broadly unchanged. It is pronounced in the state of higher profit both in the short-run and long-run forecasts. For debt ratio, it is significantly positive only in the long-run forecasts, which is in line with our result in the main text. A slight difference is observed when comparing the results of different signs of forecast revisions. Higher debt over equity boosts optimism when revising up forecasts (Table 4-A), while long-term debt generates optimism in revising down forecasts (Appendix Table 5-B). The results for the two experience variables are also robust to the change of other variables. Experience of liquidity shortage generates pessimism in the time of upward forecast revisions regardless of the time horizon of forecasts.

References

Amir, E. and Y. Ganzach (1998). Overreaction and underreaction in analysts' forecasts. *Journal of Economic Behavior and Organization 37*(3), 333–347.

Andrade, P. and H. Le Bihan (2013). Inattentive professional forecasters. *Journal of Monetary Economics 60*(8), 967–982.

Ashiya, M. (2003). Testing the rationality of Japanese GDP forecasts: The sign of forecast revision matters. *Journal of Economic Behavior and Organization 50*(2), 263–269.

Bachmann, R. and S. Elstner (2015). Firm optimism and pessimism. *European Economic Review 79*, 297–325.

Banerjee, R. N., J. Kearns, and M. J. Lombardi (2015). (Why) Is investment weak? *BIS Quarterly Review*, March 2015, 67–82.

Barberis, N. and R. Thaler (2003). A survey of behavioral finance. *Handbook of the Economics of Finance 1*, 1053–1128.

Barlevy, G. (2007). On the cyclicality of research and development. *The American Economic Review 97*(4), 1131–1164.

Ben-David, I., J. R. Graham, and C. R. Harvey (2013). Managerial miscalibration. *The Quarterly Journal of Economics 128*(4), 1547–1584.

Bloom, N., M. Floetotto, N. Jaimovich, I. Saporta-Eksten, and S. J. Terry (2012). Really uncertain business cycles. Working Paper Series 18245, National Bureau of Economic Research.

Coibion, O. and Y. Gorodnichenko (2015). Information rigidity and the expectations formation process: A simple framework and new facts. *The American Economic Review 105*(8), 2644–2678.

Coibion, O., Y. Gorodnichenko, and S. Kumar (2015). How do firms form their expectations? New survey evidence. Working Paper Series 21092, National Bureau of Economic Research.

Daniel, K., D. Hirshleifer, and A. Subrahmanyam (1998). Investor psychology and security market under-and overreactions. *The Journal of Finance 53*(6), 1839–1885.

Davies, A. and K. Lahiri (1995). A new framework for analyzing survey forecasts using three-dimensional panel data. *Journal of Econometrics 68*(1), 205–227.

De Bondt, W. F. and R. H. Thaler (1990). Do security analysts overreact? *The American Economic Review 80*(2), 52–57.

Easterwood, J. C. and S. R. Nutt (1999). Inefficiency in analysts' earnings forecasts: Systematic misreaction or systematic optimism? *The Journal of Finance 54*(5), 1777–1797.

Ehrbeck, T. and R. Waldmann (1996). Why are professional forecasters biased? Agency versus behavioral explanations. *The Quarterly Journal of Economics 111*(1), 21–40.

Erickson, T. and T. M. Whited (2000). Measurement error and the relationship between investment and q. *Journal of Political Economy 108*(5), 1027–1057.

Gennaioli, N., Y. Ma, and A. Shleifer (2016). Expectations and investment. *NBER Macroeconomics Annual 30*(1), 379–431.

Gruber, J. W. and S. B. Kamin (2015). The corporate saving glut in the aftermath of the global financial crisis. International Finance Discussion Paper 1150, Federal Reserve Board.

Hall, B. H. and J. Lerner (2010). The financing of R&D and innovation. *Handbook of the Economics of Innovation 1*, 609–639.

Hayakawa, H. (2016). *Misunderstanding of Monetary Policy–Achievement and Limit of Ambitious Experiments (in Japanese).* Keio University Press.

Hayashi, F. and T. Inoue (1991). The relation between firm growth and Q with multiple capital goods: Theory and evidence from panel data on Japanese firms. *Econometrica 59*(3), 731–753.

Hirshleifer, D., A. Low, and S. H. Teoh (2012). Are overconfident CEOs better innovators? *The Journal of Finance 67*(4), 1457–1498.

Ilut, C. L. and M. Schneider (2014). Ambiguous business cycles. *The American Economic Review 104*(8), 2368–2399.

Jensen, M. C. (1986). Agency costs of free cash flow, corporate finance, and takeovers. *The American Economic Review 76*(2), 323–329.

Kaihatsu, S. and N. Shiraki (2016). Firms' Inflation Expectations and Wage-setting Behaviors. Working Paper Series 16-E-10, Bank of Japan.

Kandel, E. and B.-Z. Zilberfarb (1999). Differential interpretation of information in inflation forecasts. *Review of Economics and Statistics 81*(2), 217–226.

Kato, N. and T. Kawamoto (2016). Corporate profits and business fixed investment: Why are firms so cautious about investment? Bank of Japan Review 16-E-2, Bank of Japan.

Korniotis, G. M. and A. Kumar (2011). Do behavioral biases adversely affect the macro-economy? *Review of Financial Studies 24*(5), 1513–1559.

Kozlowski, J., L. Veldkamp, and V. Venkateswaran (2015). The tail that wags the economy: Belief-driven business cycles and persistent stagnation. Working Paper Series 18245, National Bureau of Economic Research.

Lahiri, K. and X. Sheng (2008). Evolution of forecast disagreement in a bayesian learning model. *Journal of Econometrics 144*(2), 325–340.

Lai, Y.-L., F.-J. Lin, and Y.-H. Lin (2015). Factors affecting firm's R&D investment decisions. *Journal of Business Research 68*(4), 840–844.

Malmendier, U. and S. Nagel (2011). Depression babies: do macroeconomic experiences affect risk taking? *The Quarterly Journal of Economics 126*(1), 373–416.

Malmendier, U. and S. Nagel (2016). Learning from inflation experiences. *The Quarterly Journal of Economics 131*(1), 53–87.

Malmendier, U. and G. Tate (2005). CEO overconfidence and corporate investment. *The Journal of Finance 60*(6), 2661–2700.

Malmendier, U. and G. Tate (2008). Who makes acquisitions? CEO overconfidence and the market's reaction. *Journal of Financial Economics 89*(1), 20–43.

Malmendier, U., G. Tate, and J. Yan (2011). Overconfidence and early-life experiences: the effect of managerial traits on corporate financial policies. *The Journal of Finance 66*(5), 1687–1733.

Patton, A. J. and A. Timmermann (2010). Why do forecasters disagree? Lessons from the term structure of cross-sectional dispersion. *Journal of Monetary Economics 57*(7), 803–820.

Shleifer, A. (1986). Implementation cycles. *Journal of Political Economy 94*(6), 1163–1190.

Shleifer, A. (2000). *Inefficient Markets: An introduction to behavioural finance.* Oxford University Press.

Souleles, N. S. (2004). Expectations, heterogeneous forecast errors, and consumption: Micro evidence from the Michigan consumer sentiment surveys. *Journal of Money, Credit, and Banking 36*(1), 39–72.

Tanaka, M., N. Bloom, M. Koga, and H. Kato (2017). Firm performance and macro expectation. Unpublished manuscript.

Table 1: Biases, business cycles, and financial market variables (horizon=1)

	(1)	(2)	(3)	(4)
Panel A	Forecast error			
Dummies				
Business cycles	5.778***	5.545***		
	(1.294)	(1.312)		
News on recessions			-2.658 *	-2.600 *
			(1.327)	(1.405)
Forecast revision		0.549***		0.542***
		(0.089)		(0.095)
Fixed effect - year	NO	NO	NO	NO
Fixed effect - firm	YES	YES	YES	YES
Observations	14,949	10,643	14,949	10,643
Adj. R-squared	0.190	0.274	0.071	0.167
	(5)	(6)	(7)	(8)
Panel B	Forecast error			
Dummies				
Stock price	3.680***	3.391***		
	(1.240)	(1.104)		
Foreign exchange rate			3.735***	4.082***
			(1.105)	(1.050)
Forecast revision		0.568***		0.607***
		(0.072)		(0.096)
Fixed effect - year	NO	NO	NO	NO
Fixed effect - firm	YES	YES	YES	YES
Observations	12,575	9,358	14,949	10,643
Adj. R-squared	0.120	0.205	0.135	0.263

Notes: Yearly regressions of forecast errors of the 1-year-ahead forecasts on dummy variables and forecast revisions. Forecast errors are of industry demand growth. Panel A reports the results using the dummies representing the states of business cycles and the number of news reporting a recession. Panel B reports the results using the dummies representing the levels of stock price and foreign exchange rate. Firm fixed effect is controlled. Standard errors, shown in parentheses, are robust to serial correlation, heteroskedasticity, and cross sectional dependence. R-squared excludes fixed effects. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 2: Biases, business cycles, and financial market variables (horizon=4)

	(1)	(2)	(3)	(4)
Panel A	Forecast error			
Dummies				
Business cycles	1.403	0.634		
	(1.169)	(1.021)		
News on business cycles			-2.576	-1.463
			(1.913)	(1.796)
Forecast revision		0.506***		0.490***
		(0.047)		(0.033)
Fixed effect - year	NO	NO	NO	NO
Fixed effect - firm	YES	YES	YES	YES
Observations	13,616	9,831	13,616	9,831
Adj. R-squared	0.007	0.044	0.041	0.056
	(5)	(6)	(7)	(8)
Panel B	Forecast error			
Dummies				
Stock price	1.347	1.190		
	(2.007)	(1.992)		
Foreign exchange rate			0.277	-0.455
			(1.934)	(1.875)
Forecast revision		0.486***		0.514***
		(0.046)		(0.035)
Fixed effect - year	NO	NO	NO	NO
Fixed effect - firm	YES	YES	YES	YES
Observations	11,234	8,527	13,616	9,831
Adj. R-squared	0.009	0.042	0.000	0.044

Notes: Yearly regressions of forecast errors of the 4-year-ahead forecasts on dummy variables and forecast revisions. Forecast errors are of industry demand growth. Panel A reports the results using the dummies representing the states of business cycles and the number of news reporting a recession. Panel B reports the results using the dummies representing the levels of stock price and foreign exchange rate. Firm fixed effect is controlled. Standard errors, shown in parentheses, are robust to serial correlation, heteroskedasticity, and cross sectional dependence. R-squared excludes fixed effects. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 3-A: Biases and firm specific factors when forecast revisions are positive (horizon=1)

		(1)	(2)	(3)	(4)	(5)	(6)
		Forecast error					
Dummies	-						
Profit ratio	higher	0.315***				0.354***	0.360***
		(0.071)				(0.073)	(0.072)
	lower	-0.190***				-0.126**	-0.123**
		(0.049)				(0.056)	(0.058)
Debt ratio	higher		0.014			0.110	0.115
			(0.130)			(0.154)	(0.151)
	lower		0.005			0.060	0.057
			(0.126)			(0.103)	(0.103)
Exporting firm	-					0.142	0.140
						(0.107)	(0.107)
Experience of deficit	-			-0.238***		-0.087	-0.083
				(0.069)		(0.087)	(0.090)
Experience of liquidity shortage	-				-0.532*	-0.585**	-0.585**
					(0.283)	(0.276)	(0.273)
Forecast revision	-	0.610***	0.611***	0.611***	0.608***	0.606***	0.607***
		(0.033)	(0.034)	(0.034)	(0.040)	(0.039)	(0.039)
Fixed effect - year		YES	YES	YES	YES	YES	YES
Fixed effect - firm		YES	YES	YES	YES	YES	YES
Fixed effect - firm size		YES	YES	YES	YES	YES	NO
Observations		2,983	2,983	2,983	2,528	2,528	2,528
Adj. R-squared		0.916	0.915	0.916	0.921	0.922	0.922

Notes: Yearly regressions of forecast errors of the 1-year-ahead forecasts on dummy variables and forecast revisions, when the forecast revisions from previous year are positive. Forecast errors are of industry demand growth. The independent variables are dummy variables and forecast revisions. The dummy variables take a value of one when the firm's profit ratio or debt ratio is higher (lower) than the third (first) quartile, when the firm is an exporting firm, when the firm experienced deficit in the past 5 years, and when the firm experienced liquidity shortage in the past 5 years, respectively. Fixed effects are controlled. Standard errors, shown in parentheses, are robust to serial correlation, heteroskedasticity, and cross sectional dependence. R-squared excludes fixed effects. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 3-B: Biases and firm specific factors when forecast revisions are negative (horizon=1)

		(1)	(2)	(3)	(4)	(5)	(6)
		Forecast error					
Dummies	-						
Profit ratio	higher	0.166*				0.181*	0.180*
		(0.087)				(0.089)	(0.090)
	lower	-0.112				-0.093	-0.095
		(0.072)				(0.074)	(0.076)
Debt ratio	higher		0.033			0.121	0.123
			(0.112)			(0.112)	(0.113)
	lower		0.035			0.010	0.021
			(0.083)			(0.087)	(0.087)
Exporting firm	-					0.002	0.004
						(0.093)	(0.094)
Experience of deficit	-			-0.116*		-0.046	-0.046
				(0.063)		(0.064)	(0.064)
Experience of liquidity shortage	-				0.309	0.309	0.316
					(0.217)	(0.213)	(0.210)
Forecast revision	-	0.556***	0.556***	0.556***	0.544***	0.544***	0.545***
		(0.021)	(0.020)	(0.020)	(0.024)	(0.025)	(0.025)
Fixed effect - year		YES	YES	YES	YES	YES	YES
Fixed effect - firm		YES	YES	YES	YES	YES	YES
Fixed effect - firm size		YES	YES	YES	YES	YES	NO
Observations		6,459	6,459	6,459	5,341	5,341	5,341
Adj. R-squared		0.914	0.913	0.914	0.915	0.915	0.915

Notes: Yearly regressions of forecast errors of the 1-year-ahead forecasts on dummy variables and forecast revisions, when the forecast revisions from previous year are negative. Forecast errors are of industry demand growth. The independent variables are dummy variables and forecast revisions. The dummy variables take a value of one when the firm's profit ratio or debt ratio is higher (lower) than the third (first) quartile, when the firm is an exporting firm, when the firm experienced deficit in the past 5 years, and when the firm experienced liquidity shortage in the past 5 years, respectively. Fixed effects are controlled. Standard errors, shown in parentheses, are robust to serial correlation, heteroskedasticity, and cross sectional dependence. R-squared excludes fixed effects. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 4-A: Biases and firm specific factors when forecast revisions are positive (horizon=4)

		(1)	(2)	(3)	(4)	(5)	(6)
		Forecast error					
Dummies	-						
Profit ratio	higher	0.468***				0.534***	0.532***
		(0.076)				(0.066)	(0.065)
	lower	-0.143**				-0.097	-0.101
		(0.066)				(0.074)	(0.074)
Debt ratio	higher		0.165			0.346**	0.383**
			(0.146)			(0.160)	(0.171)
	lower		-0.158			-0.149	-0.152
			(0.101)			(0.118)	(0.122)
Exporting firm	-					0.091	0.085
						(0.123)	(0.122)
Experience of deficit	-			-0.166		-0.076	-0.077
				(0.101)		(0.115)	(0.114)
Experience of liquidity shortage	-				-0.738**	-0.755**	-0.705**
					(0.326)	(0.354)	(0.337)
Forecast revision	-	0.624***	0.626***	0.626***	0.649***	0.648***	0.648***
		(0.024)	(0.024)	(0.024)	(0.029)	(0.028)	(0.028)
Fixed effect - year		YES	YES	YES	YES	YES	YES
Fixed effect - firm		YES	YES	YES	YES	YES	YES
Fixed effect - firm size		YES	YES	YES	YES	YES	NO
Observations		3,714	3,714	3,714	3,072	3,072	3,072
Adj. R-squared		0.904	0.903	0.903	0.909	0.911	0.911

Notes: Yearly regressions of forecast errors of the 4-year-ahead forecasts on dummy variables and forecast revisions, when the forecast revisions from previous year are positive. Forecast errors are of industry demand growth. The independent variables are dummy variables and forecast revisions. The dummy variables take a value of one when the firm's profit ratio or debt ratio is higher (lower) than the third (first) quartile, when the firm is an exporting firm, when the firm experienced deficit in the past 5 years, and when the firm experienced liquidity shortage in the past 5 years, respectively. Fixed effects are controlled. Standard errors, shown in parentheses, are robust to serial correlation, heteroskedasticity, and cross sectional dependence. R-squared excludes fixed effects. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 4-B: Biases and firm specific factors when forecast revisions are negative (horizon=4)

		(1)	(2)	(3)	(4)	(5)	(6)
		Forecast error					
Dummies	-						
Profit ratio	higher	0.228***				0.251***	0.250***
		(0.076)				(0.077)	(0.078)
	lower	-0.096				-0.067	-0.070
		(0.094)				(0.088)	(0.087)
Debt ratio	higher		0.024			0.122	0.130
			(0.133)			(0.182)	(0.185)
	lower		-0.010			0.026	0.021
			(0.067)			(0.072)	(0.071)
Exporting firm	-					0.085	0.083
						(0.072)	(0.075)
Experience of deficit	-			-0.127		-0.071	-0.067
				(0.087)		(0.071)	(0.070)
Experience	-				-0.252	-0.255	-0.250
of liquidity shortage					(0.408)	(0.390)	(0.374)
Forecast revision	-	0.397***	0.399***	0.398***	0.398***	0.395***	0.395***
		(0.028)	(0.028)	(0.028)	(0.036)	(0.035)	(0.035)
Fixed effect - year		YES	YES	YES	YES	YES	YES
Fixed effect - firm		YES	YES	YES	YES	YES	YES
Fixed effect - firm size		YES	YES	YES	YES	YES	NO
Observations		4,476	4,476	4,476	3,676	3,676	3,676
Adj. R-squared		0.893	0.892	0.892	0.894	0.895	0.895

Notes: Yearly regressions of forecast errors of the 4-year-ahead forecasts on dummy variables and forecast revisions, when the forecast revisions from previous year are negative. Forecast errors are of industry demand growth. The independent variables are dummy variables and forecast revisions. The dummy variables take a value of one when the firm's profit ratio or debt ratio is higher (lower) than the third (first) quartile, when the firm is an exporting firm, when the firm experienced deficit in the past 5 years, and when the firm experienced liquidity shortage in the past 5 years, respectively. Fixed effects are controlled. Standard errors, shown in parentheses, are robust to serial correlation, heteroskedasticity, and cross sectional dependence. R-squared excludes fixed effects. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 5: Firms' expectation and investment plan

	All firms		Manufacturing firms	
	(1)	(2)	(3)	(4)
	Investment plan			
1-year-ahead forecast	0.140**		0.157***	
	(0.053)		(0.052)	
3-year-ahead forecast		0.196***		0.249***
		(0.059)		(0.070)
Tobin's Q	0.038	0.042*	0.072**	0.079***
	(0.024)	(0.024)	(0.032)	(0.027)
Cash flow/Asset	33.939***	33.959***	36.523***	36.546***
	(5.141)	(5.264)	(5.779)	(5.581)
Volatility of profit growth	0.005***	0.005***	0.007***	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)
Debt/Asset	-4.746***	-4.514***	-4.217**	-4.095**
	(1.186)	(1.101)	(1.693)	(1.526)
Capital stock growth	-0.000**	-0.000**	-0.000*	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
Fixed effect - year	YES	YES	YES	YES
Fixed effect - firm	YES	YES	YES	YES
Fixed effect - firm size	YES	YES	YES	YES
Observations	12,447	12,321	7,789	7,694
Adj. R-squared	0.050	0.052	0.057	0.058

Notes: Yearly regressions of firms' investment plans over the next 3 years on the 1-year or 3-year industry demand forecasts and other possible determinants of investment: Tobin's Q; cash flow over asset; volatility of profit growth in the past 5 years; debt over asset; and capital stock growth from the preceding year. Tobin's Q is average Q, defined as (Market value of firm equity + Long-term debt + Debt in current liability)/Total asset. Fixed effects are controlled. Columns (1) and (2) are the results of all firms, and columns (3) and (4) are the results of manufacturing firms. Standard errors, shown in parentheses, are robust to serial correlation, heteroskedasticity, and cross sectional dependence. R-squared excludes fixed effects. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 6: Firms' expectation and employment plan

	All firms		Manufacturing firms	
	(1)	(2)	(3)	(4)
	Employment plan			
1-year-ahead forecast	0.202***		0.167***	
	(0.029)		(0.035)	
3-year-ahead forecast		0.257***		0.213***
		(0.019)		(0.022)
Wage growth	-0.000	0.001	-0.002	0.001
	(0.002)	(0.001)	(0.002)	(0.001)
Labor market slackness	-0.047***	-0.045***	-0.008	-0.010
	(0.009)	(0.008)	(0.009)	(0.010)
Fixed effect - year	YES	YES	YES	YES
Fixed effect - firm	YES	YES	YES	YES
Fixed effect - firm size	YES	YES	YES	YES
Observations	11,368	11,180	8,033	7,894
Adj. R-squared	0.099	0.103	0.097	0.099

Notes: Yearly regressions of firms' employment plans over the next 3 years on the 1-year or 3-year industry demand forecasts and other possible determinants of employment: growth of average wage per employee; labor market slackness at industry that each firm belongs to. Columns (1) and (2) are the result of all firms, and columns (3) and (4) are the result of manufacturing firms. Fixed effects are controlled. Standard errors, shown in parentheses, are robust to serial correlation, heteroskedasticity, and cross sectional dependence. R-squared excludes fixed effects. *, **, *** denote significance at the 10%, 5%, 1% levels, respectively.

Table 7: Investment and firm-specific biases

	(1)	(2)	(3)	(4)	(5)	(6)
	Investment/Capital stock					
Optimism bias	0.015**	0.011**			0.014**	0.010*
	(0.006)	(0.005)			(0.006)	(0.005)
Pessimism bias			-0.010**	-0.009**	-0.007*	-0.007*
			(0.004)	(0.004)	(0.004)	(0.004)
Tobin's Q	0.000*	0.001	0.000**	0.001	0.000*	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Cash flow/Asset		0.452***		0.453***		0.449***
		(0.054)		(0.054)		(0.054)
Volatility of profit growth		-0.000*		-0.000		-0.000*
		(0.000)		(0.000)		(0.000)
Debt/Asset		-0.002		-0.006		-0.003
		(0.018)		(0.018)		(0.018)
Fixed effect - year	YES	YES	YES	YES	YES	YES
Fixed effect - firm	NO	NO	NO	NO	NO	NO
Fixed effect - firm size	YES	YES	YES	YES	YES	YES
Observations	12,895	9,156	12,895	9,156	12,895	9,156
Adj. R-squared	0.047	0.051	0.047	0.051	0.048	0.051

Notes: Yearly regressions of the firm's investment over capital stock on optimism and pessimism bias, and other possible determinants of investment: Tobin's Q; cash flow over asset; volatility of profit growth in the past 5 years; debt over asset. Tobin's Q is average Q, defined as (Market value of firm equity + Long-term debt + Debt in current liability)/Total asset. Fixed effects are controlled. Standard errors, shown in parentheses, are robust to serial correlation, heteroskedasticity, and cross sectional dependence. R-squared excludes fixed effects. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 8: R&D expenditures and firm-specific biases

	(1)	(2)	(3)	(4)	(5)	(6)
	R&D/Total asset					
Optimism bias	0.005***	0.005***			0.004***	0.004***
	(0.000)	(0.001)			(0.000)	(0.001)
Pessimism bias			-0.006***	-0.006***	-0.005***	-0.005***
			(0.001)	(0.002)	(0.001)	(0.002)
Tobin's Q	0.000**	0.000*	0.000**	0.000**	0.000**	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Cash flow/Asset	0.071***	0.076***	0.071***	0.076***	0.071***	0.075***
	(0.012)	(0.012)	(0.012)	(0.013)	(0.012)	(0.013)
Sales/Asset	0.001	0.002	0.001	0.002*	0.001	0.002*
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Debt/Asset	-0.018***	-0.019***	-0.020***	-0.021***	-0.019***	-0.019***
	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)
Volatility of profit growth	-0.000	0.000	0.000	0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Overseas production ratio		-0.000		-0.000		-0.000
		(0.000)		(0.000)		(0.000)
Wage		-0.000*		-0.000*		-0.000*
		(0.000)		(0.000)		(0.000)
Fixed effect - year	YES	YES	YES	YES	YES	YES
Fixed effect - firm	NO	NO	NO	NO	NO	NO
Fixed effect - firm size	YES	YES	YES	YES	YES	YES
Observations	2,502	2,223	2,502	2,223	2,502	2,223
Adj. R-squared	0.113	0.126	0.115	0.128	0.121	0.133

Notes: Yearly regressions of the firm's R&D expenditures on optimism and pessimism bias, and other possible determinants of R&D: Tobin's Q; cash flow over asset; sales over asset; debt over asset; volatility of profit growth in the past 5 years; overseas production ratio. Tobin's Q is average Q, defined as (Market value of firm equity + Long-term debt + Debt in current liability)/Total asset. Fixed effects are controlled. Standard errors, shown in parentheses, are robust to serial correlation, heteroskedasticity, and cross sectional dependence. R-squared excludes fixed effects. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 9: Investment and state-dependent biases

	(1)	(2)	(3)	(4)	(5)	(6)
	Investment/Capital stock					
Optimism bias	0.007		0.004	0.001		-0.001
	(0.005)		(0.005)	(0.005)		(0.005)
Pessimism bias		-0.013**	-0.012**		-0.012***	-0.013***
		(0.005)	(0.005)		(0.004)	(0.004)
Tobin's Q	0.001	0.001*	0.001	0.002	0.002	0.002
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Cashflow/Asset	0.453***	0.449***	0.448***	0.427***	0.422***	0.422***
	(0.054)	(0.055)	(0.055)	(0.080)	(0.081)	(0.081)
Volatility of profit growth	-0.000	-0.000	-0.000	-0.000*	-0.000*	-0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Debt/Asset	-0.005	-0.004	-0.004	-0.015	-0.015	-0.015
	(0.019)	(0.018)	(0.019)	(0.027)	(0.027)	(0.027)
Fixed effect - year	YES	YES	YES	YES	YES	YES
Fixed effEct - firm	NO	NO	NO	YES	YES	YES
Fixed effect - firm size	YES	YES	YES	YES	YES	YES
Observations	9,156	9,156	9,156	9,156	9,156	9,156
Adj. R-squared	0.050	0.051	0.051	0.043	0.044	0.044

Notes: Yearly regressions of the firm's investment over capital stock on optimism and pessimism bias, and other possible determinants of investment: Tobin's Q; cash flow over asset; volatility of profit growth in the past 5 years; debt over asset. Tobin's Q is average Q, defined as (Market value of firm equity + Long-term debt + Debt in current liability)/ Total asset. Fixed effects are controlled. Standard errors, shown in parentheses, are robust to serial correlation, heteroskedasticity, and cross sectional dependence. R-squared excludes fixed effects. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 10: R&D expenditures and state-dependent biases

	(1)	(2)	(3)	(4)	(5)	(6)
	R&D/Total asset					
Optimism bias	0.004**		0.003**	0.001*		0.001*
	(0.001)		(0.001)	(0.001)		(0.001)
Pessimism bias		-0.003**	-0.002		-0.000	-0.000
		(0.001)	(0.001)		(0.000)	(0.000)
Tobin's Q	0.000**	0.000**	0.000**	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Cash flow/Asset	0.076***	0.076***	0.075***	0.021***	0.020***	0.021***
	(0.011)	(0.012)	(0.011)	(0.005)	(0.005)	(0.005)
Sales/Asset	0.002	0.002	0.002	0.010***	0.010***	0.010***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Debt/Asset	-0.020***	-0.020***	-0.020***	-0.010***	-0.010***	-0.010***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
Volatility of profit growth	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Overseas production ratio	-0.000	-0.000	-0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Wage	-0.000*	-0.000*	-0.000*	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Fixed effect - year	YES	YES	YES	YES	YES	YES
Fixed effect - firm	NO	NO	NO	YES	YES	YES
Fixed effect - firm size	YES	YES	YES	YES	YES	YES
Observations	2,223	2,223	2,223	2,223	2,223	2,223
Adj. R-squared	0.123	0.119	0.124	0.110	0.107	0.110

Notes: Yearly regressions of the firm's R&D expenditures on optimism and pessimism bias, and other possible determinants of R&D: Tobin's Q; cash flow over asset; sales over asset; debt over asset; volatility of profit growth in the past 5 years; overseas production ratio. Tobin's Q is average Q, defined as (Market value of firm equity + Long-term debt + Debt in current liability)/Total asset. Fixed effects are controlled. Standard errors, shown in parentheses, are robust to serial correlation, heteroskedasticity, and cross sectional dependence. R-squared excludes fixed effects. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 11: Investment and experience of liquidity shortage

	All firms		Manufacturing firms	
	(1)	(2)	(3)	(4)
	Investment/Capital stock			
Experience of liquidity shortage in 1998	-0.040***		-0.020	
	(0.005)		(0.013)	
Experience of liquidity shortage in 2008		-0.048***		-0.042***
		(0.006)		(0.006)
Tobin's Q	0.025**	0.025**	0.032*	0.033*
	(0.007)	(0.007)	(0.012)	(0.012)
Cash flow/Asset	0.109	0.120	0.267**	0.275**
	(0.087)	(0.087)	(0.065)	(0.065)
Volatility of profit growth	-0.000	-0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Debt/Asset	-0.033**	-0.034**	-0.079	-0.080
	(0.012)	(0.011)	(0.044)	(0.043)
Fixed effect - year	YES	YES	YES	YES
Fixed effect - firm	NO	NO	NO	NO
Fixed effect - firm size	YES	YES	YES	YES
Observations	1,993	1,993	1,193	1,193
Adj. R-squared	0.014	0.014	0.049	0.050

Notes: Yearly regressions of the firm's investment over capital stock on the dummy variable that take a value of one when the firm experienced a severe liquidity shortage in 1998 or 2008, and other possible determinants of investment: Tobin's Q; cash flow over asset; volatility of profit growth in past 5 years; debt over asset. Tobin's Q is average Q, defined as (Market value of firm equity + Long-term debt + Debt in current liability)/Total asset. Fixed effects are controlled. Columns (1) and (2) are the results of all firms, and columns (3) and (4) are the results of manufacturing firms. Standard errors, shown in parentheses, are robust to serial correlation, heteroskedasticity, and cross sectional dependence. R-squared excludes fixed effects. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Appendix Table 1: Biases, firm size and year

	Horizon=1				Horizon=4			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Forecast error							
Forecast revision	0.542***	0.517***	0.626***	0.616***	0.493***	0.475***	0.508***	0.509***
	(0.013)	(0.020)	(0.078)	(0.066)	(0.010)	(0.018)	(0.030)	(0.033)
Dummies								
Size of capital II		0.471***				0.322***		
		(0.064)				(0.052)		
Size of capital III		0.732***				0.565***		
		(0.055)				(0.059)		
Size of capital IV		0.768***				0.561***		
		(0.046)				(0.075)		
Periods after 1998			-2.400				-2.052	
			(1.662)				(1.243)	
Periods after 2000				-0.292				-0.846
				(2.108)				(1.096)
Fixed effect - year	YES	YES	NO	NO	YES	YES	NO	NO
Fixed effect - firm	YES	NO	YES	YES	YES	NO	YES	YES
Observations	10,643	10,643	10,643	10,643	9,831	9,831	9,831	9,831
Adj. R-squared	0.920	0.869	0.146	0.100	0.908	0.831	0.111	0.079

Notes: Yearly regressions of forecast errors of the 1-year-ahead forecasts on dummy variables and forecast revisions. Forecast errors are of industry demand growth. Size of capital II, III, and IV represent firms with capital size of 1 to 5 billion yen, 5 to 10 billion yen, and 10 billion yen or more. Size of capital I, omitted in the estimation, represents firms with capital size of less than 1 billion yen. "Periods after 1998" and "Periods after 2000" denote dummy variables that take a value of one for samples after 1998 or 2000. Fixed effects are controlled. Standard errors, shown in parentheses, are robust to serial correlation, heteroskedasticity, and cross sectional dependence. R-squared excludes fixed effects. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Appendix Table 2: Biases, business cycles and financial market variable (horizon=1)

	(1)	(2)	(3)	(4)
	Forecast error			
Dummies				
Business cycles	5.462***			
	(1.341)			
News on recessions		-2.548*		
		(1.396)		
Stock price			3.331***	
			(1.083)	
Foreign exchange rate				4.040***
				(1.035)
Forecast revision	0.635***	0.646***	0.726***	0.704***
	(0.111)	(0.107)	(0.095)	(0.112)
Volatility × Forecast revision	-0.363*	-0.436*	-0.596***	-0.417**
	(0.200)	(0.234)	(0.204)	(0.195)
Fixed effect - year	NO	NO	NO	NO
Fixed effect - firm	YES	YES	YES	YES
Observations	10,643	10,643	9,358	10,643
Adj. R-squared	0.281	0.177	0.227	0.272

Notes: Yearly regressions of forecast errors of the 1-year-ahead forecasts on dummy variables and forecast revisions, and interaction terms of the volatility of monthly business cycle index and the forecast revisions. Forecast errors are of industry demand growth. The dummy variables represent the states of business cycles, the numbers of news reporting a recession, the levels of stock price and foreign exchange rate. Firm fixed effect is controlled. Standard errors, shown in parentheses, are robust to serial correlation, heteroskedasticity, and cross sectional dependence. R-squared excludes fixed effects. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Appendix Table 3: Biases, business cycles and financial market variable (horizon=4)

	(1)	(2)	(3)	(4)
	Forecast error			
Dummies				
Business cycles	0.634			
	(1.022)			
News on business cycles		-1.458		
		(1.801)		
Stock price			1.199	
			(1.993)	
Foreign exchange rate				-0.446
				(1.874)
Forecast revision	0.487***	0.476***	0.458***	0.497***
	(0.054)	(0.042)	(0.054)	(0.037)
Volatility × Forecast revision	0.108	0.081	0.137*	0.097**
	(0.067)	(0.096)	(0.070)	(0.044)
Fixed effect - year	NO	NO	NO	NO
Fixed effect - firm	YES	YES	YES	YES
Observations	9,831	9,831	8,527	9,831
Adj. R-squared	0.044	0.057	0.043	0.044

Notes: Yearly regressions of forecast errors of the 4-year-ahead forecasts on dummy variables and forecast revisions, and interaction terms of the volatility of monthly business cycle index and the forecast revisions. Forecast errors are of industry demand growth. The dummy variables represent the states of business cycles, the numbers of news reporting recessions, the levels of stock price and foreign exchange rate. Firm fixed effect is controlled. Standard errors, shown in parentheses, are robust to serial correlation, heteroskedasticity, and cross sectional dependence. R-squared excludes fixed effects. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Appendix Table 4-A: Biases and firm specific factors when forecast revisions are positive (horizon=1)

		(1)	(2)	(3)	(4)	(5)	(6)
		Forecast error					
Dummies	-						
Profit ratio	higher	0.058				0.116*	0.123*
		(0.076)				(0.067)	(0.069)
	lower	-0.252**				-0.179	-0.177
		(0.104)				(0.113)	(0.114)
Debt ratio	higher		0.041			0.105	0.103
			(0.057)			(0.067)	(0.067)
	lower		-0.124			-0.081	-0.090
			(0.161)			(0.182)	(0.182)
Exporting firm	-					0.137	0.135
						(0.103)	(0.102)
Experience of deficit	-			-0.238***		-0.118	-0.112
				(0.069)		(0.089)	(0.092)
Experience of liquidity shortage	-				-0.532*	-0.523*	-0.519*
					(0.283)	(0.278)	(0.277)
Forecast revision	-	0.612***	0.611***	0.611***	0.608***	0.607***	0.608***
		(0.034)	(0.034)	(0.034)	(0.040)	(0.041)	(0.041)
Fixed effect - year		YES	YES	YE S	YES	YES	YES
Fixed effect - firm		YES	YES	YES	YES	YES	YES
Fixed effect - firm size		YES	YES	YES	YES	YES	NO
Observations		2,983	2,983	2,983	2,528	2,528	2,528
Adj. R-squared		0.916	0.916	0.916	0.921	0.922	0.922

Notes: Yearly regressions of forecast errors of the 1-year-ahead forecast on dummy variables and forecast revisions, when the forecast revisions from previous year are positive. Forecast errors are of industry demand growth. The independent variables are dummy variables and forecast revisions. The dummy variables take a value of one when the firm's profit ratio or debt ratio is higher (lower) than the third (first) quartile, when the firm is an exporting firm, when the firm experienced deficit in the past 5 years, and when the firm experienced liquidity shortage in the past 5 years, respectively. Fixed effects are controlled. Standard errors, shown in parentheses, are robust to serial correlation, heteroskedasticity, and cross sectional dependence. R-squared excludes fixed effects. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Appendix Table 4-B: Biases and firm specific factors when forecast revisions are negative (horizon=1)

		(1)	(2)	(3)	(4)	(5)	(6)
		Forecast error					
Dummies	-						
Profit ratio	higher	0.288***				0.287***	0.291***
		(0.079)				(0.071)	(0.072)
	lower	-0.039				0.005	0.005
		(0.072)				(0.078)	(0.079)
Debt ratio	higher		-0.046			-0.031	-0.020
			(0.045)			(0.044)	(0.044)
	lower		0.032			-0.002	0.004
			(0.040)			(0.033)	(0.033)
Exporting firm	-					-0.004	-0.002
						(0.092)	(0.093)
Experience of deficit	-			-0.116*		-0.057	-0.057
				(0.063)		(0.070)	(0.070)
Experience of liquidity shortage	-				0.309	0.275	0.284
					(0.217)	(0.222)	(0.220)
Forecast revision	-	0.556***	0.555***	0.556***	0.544***	0.544***	0.545***
		(0.021)	(0.020)	(0.020)	(0.024)	(0.025)	(0.025)
Fixed Effect - year		YES	YES	YES	YES	YES	YES
Fixed Effect - firm		YES	YES	YES	YES	YES	YES
Fixed Effect - firm size		YES	YES	YES	YES	YES	NO
Observations		6,459	6,459	6,459	5,341	5,341	5,341
Adj. R-squared		0.914	0.913	0.914	0.915	0.915	0.915

Notes: Yearly regressions of forecast errors of the 1-year-ahead forecast on dummy variables and forecast revisions, when the forecast revisions from previous year are negative. Forecast errors are of industry demand growth. The independent variables are dummy variables and forecast revisions. The dummy variables take a value of one when the firm's profit ratio or debt ratio is higher (lower) than the third (first) quartile, when the firm is an exporting firm, when the firm experienced deficit in the past 5 years, and when the firm experienced liquidity shortage in the past 5 years, respectively. Fixed effects are controlled. Standard errors, shown in parentheses, are robust to serial correlation, heteroskedasticity, and cross sectional dependence. R-squared excludes fixed effects. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Appendix Table 5-A: Biases and firm specific factors when forecast revisions are positive (horizon=4)

		(1)	(2)	(3)	(4)	(5)	(6)
		Forecast error					
Dummies	-						
Profit ratio	higher	0.173*				0.216**	0.216**
		(0.091)				(0.076)	(0.079)
	lower	-0.215***				-0.140*	-0.133*
		(0.069)				(0.078)	(0.077)
Debt ratio	higher		-0.081			-0.056	-0.056
			(0.060)			(0.065)	(0.062)
	lower		0.022			0.054	0.035
			(0.097)			(0.097)	(0.095)
Exporting firm	-					0.067	0.059
						(0.125)	(0.123)
Experience of deficit	-			-0.166		-0.065	-0.067
				(0.101)		(0.115)	(0.115)
Experience of liquidity shortage	-				-0.738**	-0.773**	-0.719**
					(0.326)	(0.361)	(0.339)
Forecast revision	-	0.626***	0.626***	0.626***	0.649***	0.651***	0.650***
		(0.024)	(0.024)	(0.024)	(0.029)	(0.028)	(0.028)
Fixed effect - year		YES	YES	YES	YES	YES	YES
Fixed effect - firm		YES	YES	YES	YES	YES	YES
Fixed effect - firm size		YES	YES	YES	YES	YES	NO
Observations		3,714	3,714	3,714	3,072	3,072	3,072
Adj. R-squared		0.903	0.903	0.903	0.909	0.910	0.909

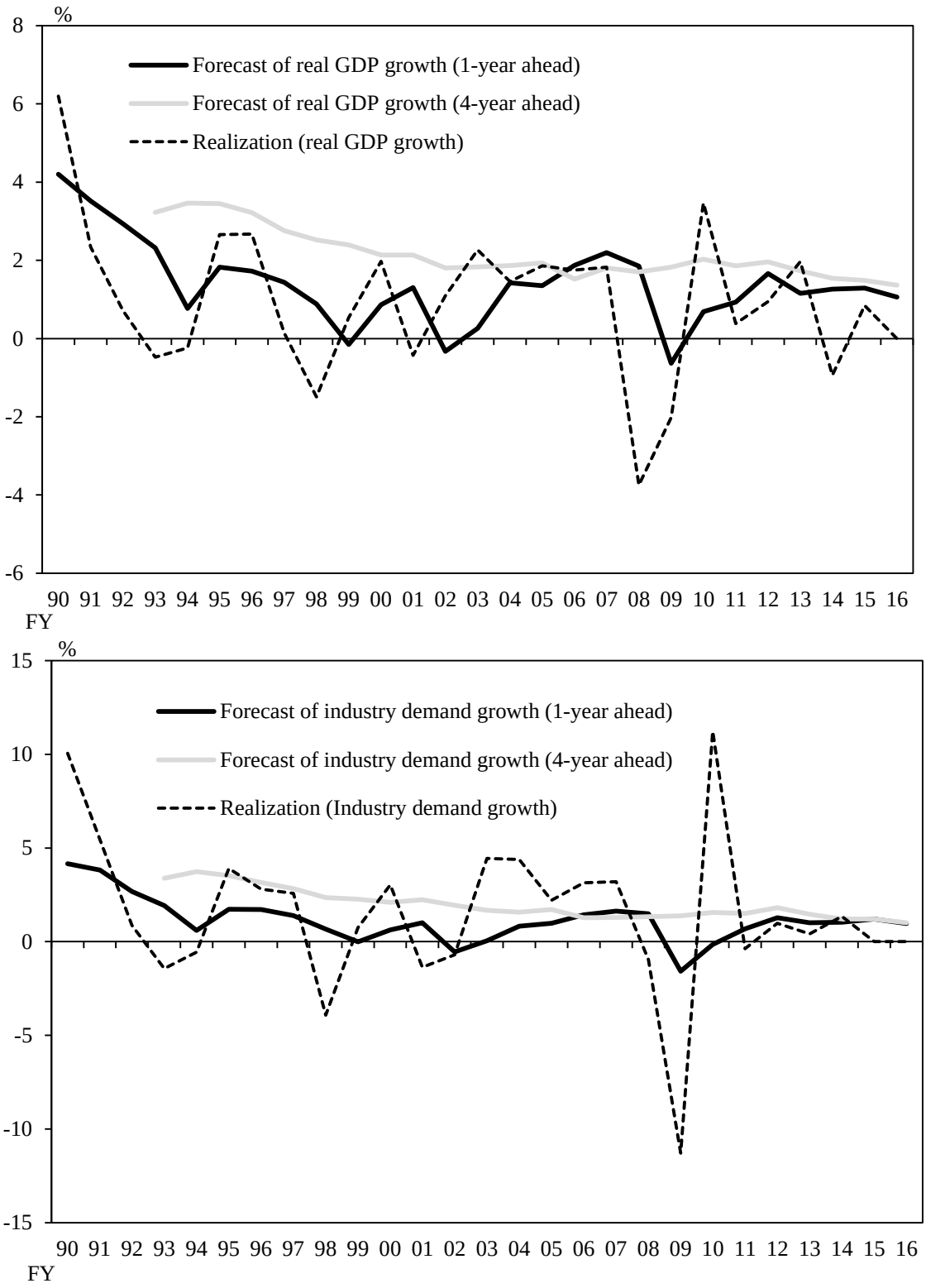
Notes: Yearly regressions of forecast errors of the 4-year-ahead forecast on dummy variables and forecast revisions, when the forecast revisions from previous year are positive. Forecast errors are of industry demand growth. The independent variables are dummy variables and forecast revisions. The dummy variables take a value of one when the firm's profit ratio or debt ratio is higher (lower) than the third (first) quartile, when the firm is an exporting firm, when the firm experienced deficit in the past 5 years, and when the firm experienced liquidity shortage in the past 5 years, respectively. Fixed effects are controlled. Standard errors, shown in parentheses, are robust to serial correlation, heteroskedasticity, and cross sectional dependence. R-squared excludes fixed effects. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Appendix Table 5-B: Biases and firm specific factors when forecast revisions are negative (horizon=4)

		(1)	(2)	(3)	(4)	(5)	(6)
		Forecast error					
Dummies	-						
Profit ratio	higher	0.229***				0.242***	0.244***
		(0.062)				(0.068)	(0.068)
	lower	-0.104				-0.088	-0.090
		(0.076)				(0.065)	(0.065)
Debt ratio	higher		0.097*			0.117**	0.118**
			(0.054)			(0.055)	(0.053)
	lower		-0.032			-0.059	-0.066
			(0.051)			(0.063)	(0.066)
Exporting firm	-					0.082	0.080
						(0.075)	(0.078)
Experience of deficit	-			-0.127		-0.068	-0.063
				(0.087)		(0.063)	(0.062)
Experience of liquidity shortage	-				-0.252	-0.256	-0.252
					(0.408)	(0.391)	(0.376)
Forecast revision	-	0.397***	0.399***	0.398***	0.398***	0.395***	0.395***
		(0.028)	(0.028)	(0.028)	(0.036)	(0.035)	(0.035)
Fixed effect - year		YES	YES	YES	YES	YES	YES
Fixed effect - firm		YES	YES	YES	YES	YES	YES
Fixed effect - firm size		YES	YES	YES	YES	YES	NO
Obs.		4,476	4,476	4,476	3,676	3,676	3,676
Adj. R-squared		0.893	0.892	0.892	0.894	0.895	0.895

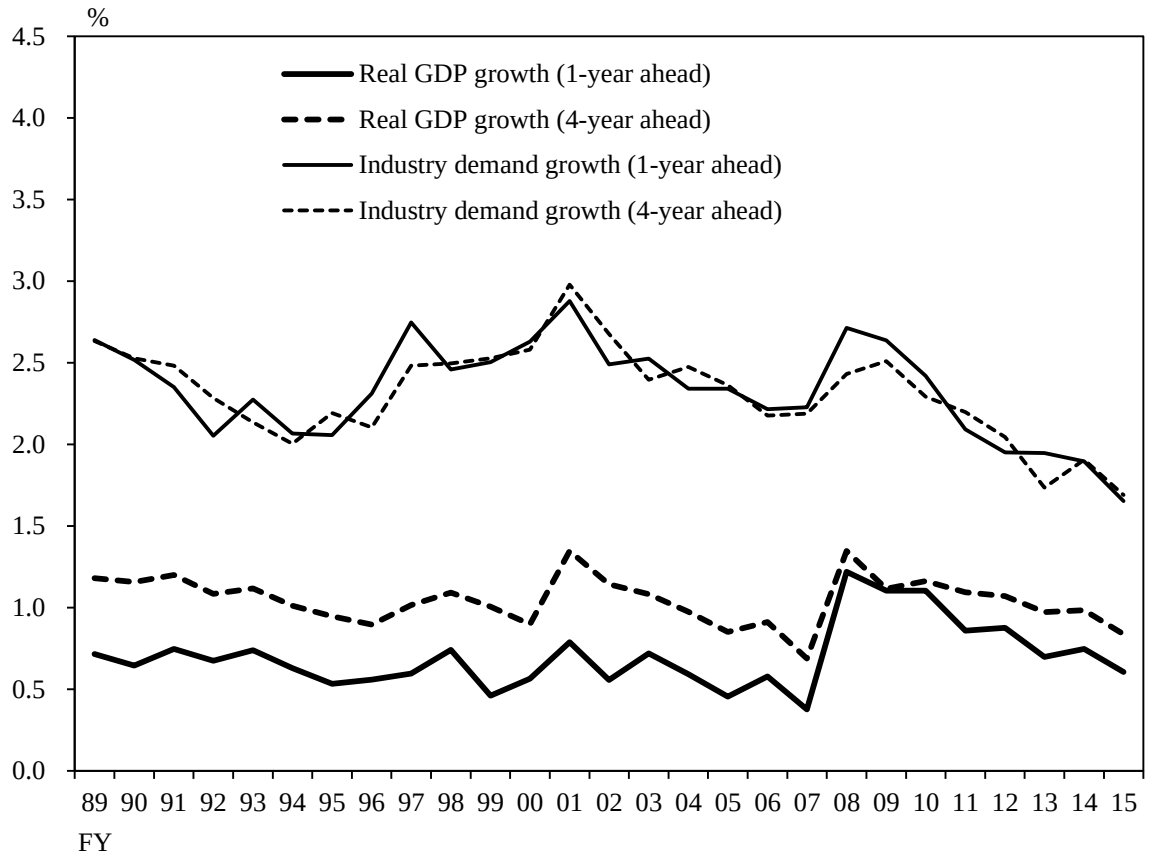
Notes: Yearly regressions of forecast errors of the 4-year-ahead forecast on dummy variables and forecast revisions, when the forecast revisions from previous year are negative. Forecast errors are of industry demand growth. The independent variables are dummy variables and forecast revisions. The dummy variables take a value of one when the firm's profit ratio or debt ratio is higher (lower) than the third (first) quartile, when the firm is an exporting firm, when the firm experienced deficit in the past 5 years, and when the firm experienced liquidity shortage in the past 5 years, respectively. Fixed effects are controlled. Standard errors, shown in parentheses, are robust to serial correlation, heteroskedasticity, and cross sectional dependence. R-squared excludes fixed effects. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Figure 1 Forecasts and realizations
(Upper panel: Real GDP, Lower panel: Industry demand)



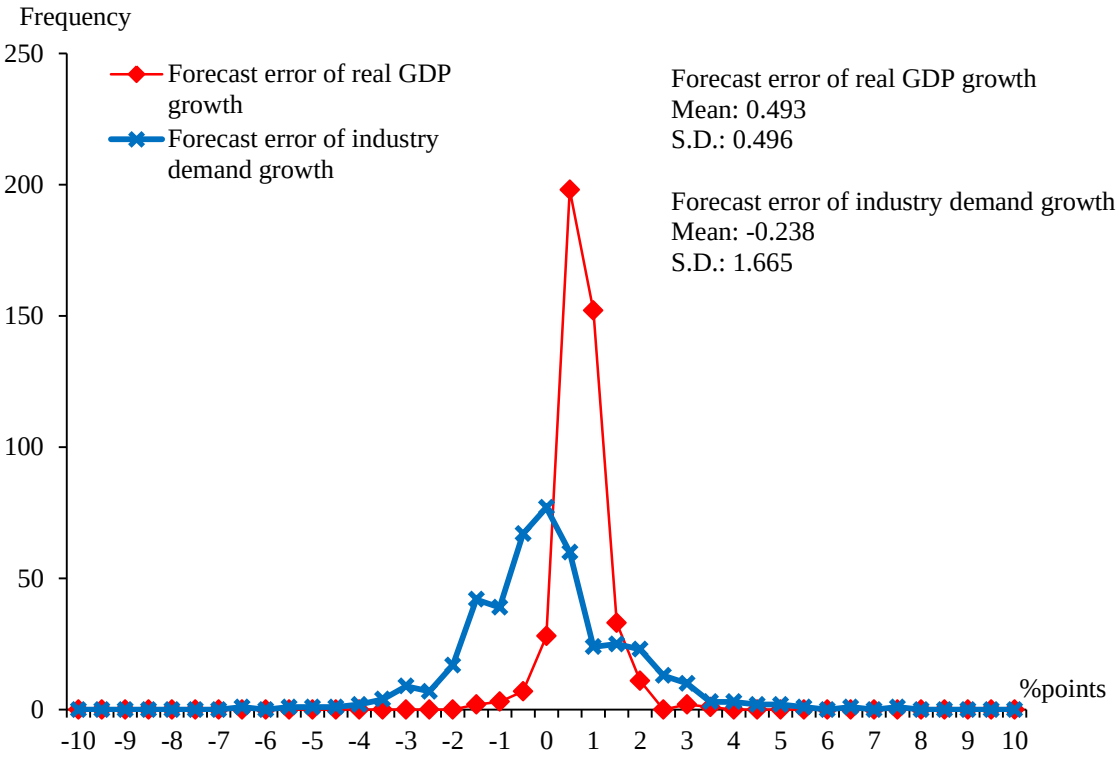
Notes: Firms' forecasts of 1-year-ahead growth rate (solid line), 4-year-ahead growth rate (gray line), and the realized growth rate (dotted line). The growth rate is annual rate on a fiscal year basis. The upper panel describes them for the real GDP, and the lower panel describes them for industry demand. The horizontal axis depicts fiscal year. The forecast data is plotted at the time of target year of forecast.

Figure 2 Disagreement of forecasts



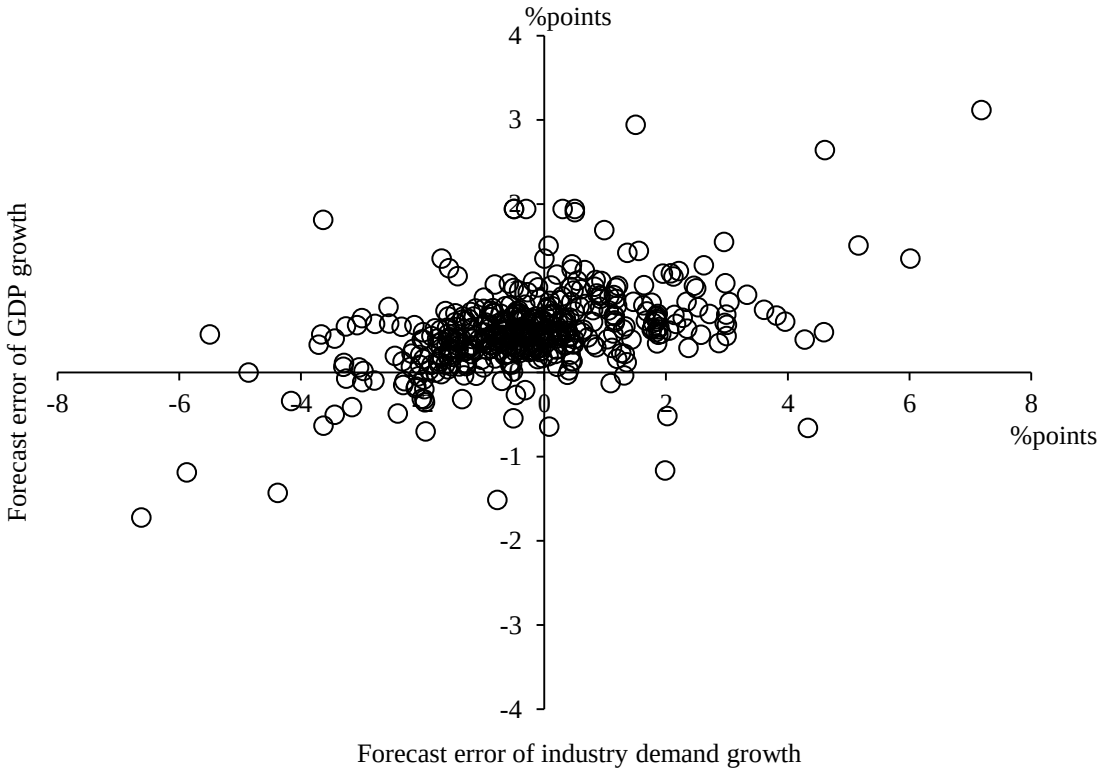
Notes: Firms' disagreement of forecasts calculated as variance of firms' forecasts for each year. Disagreements of real GDP growth are shown in thick lines and those of industry demand growth are shown in thin lines (1-year ahead: solid, 4-year ahead: dotted). Each figure is plotted at the time of forecast, and the horizontal axis depicts fiscal year.

Figure 3 Distribution of historical mean of forecast errors



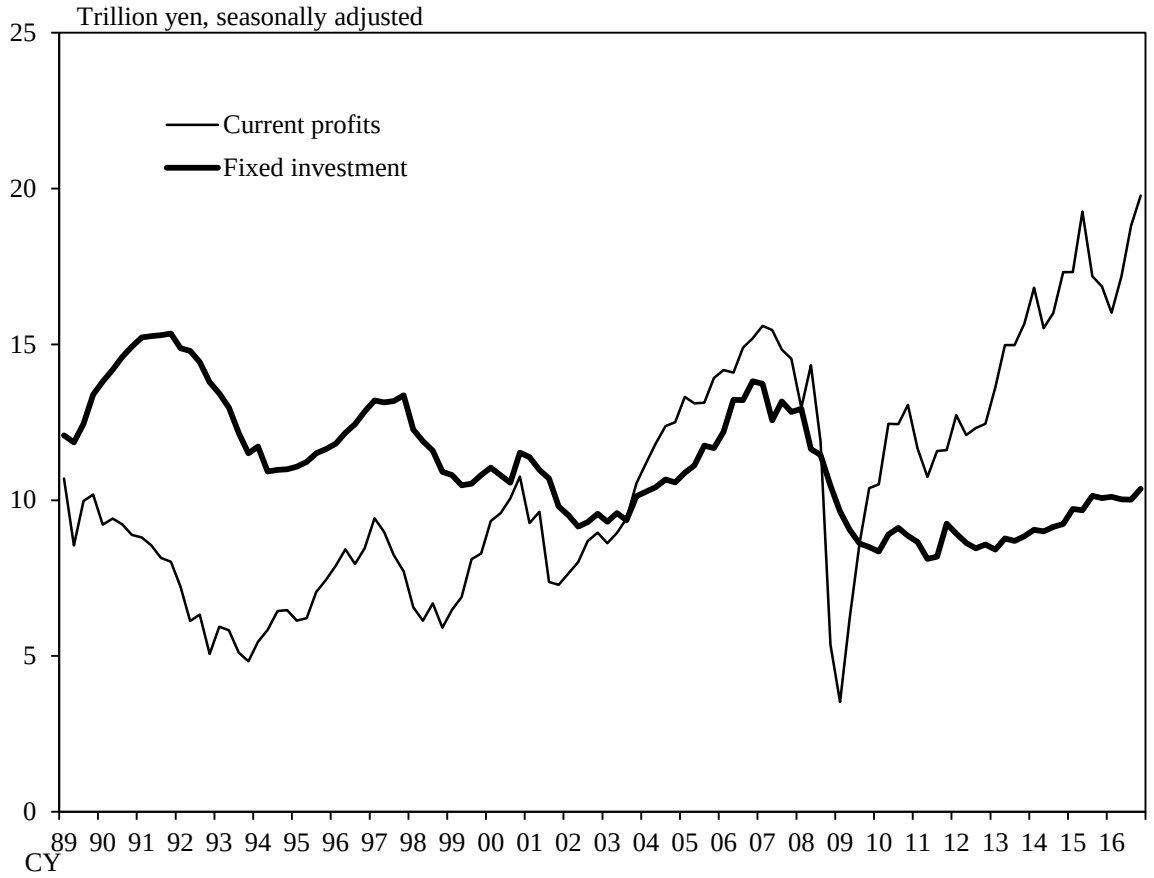
Notes: Distribution of historical mean of forecast error for each firm. Forecast error is calculated based on the 1-year-ahead forecast. Distribution for real GDP growth is shown in red and that for industry demand growth is shown in blue. The vertical axis represents the number of firms of which forecast errors take a range of values shown in the horizontal axis.

Figure 4 Forecast errors of GDP growth and industry demand



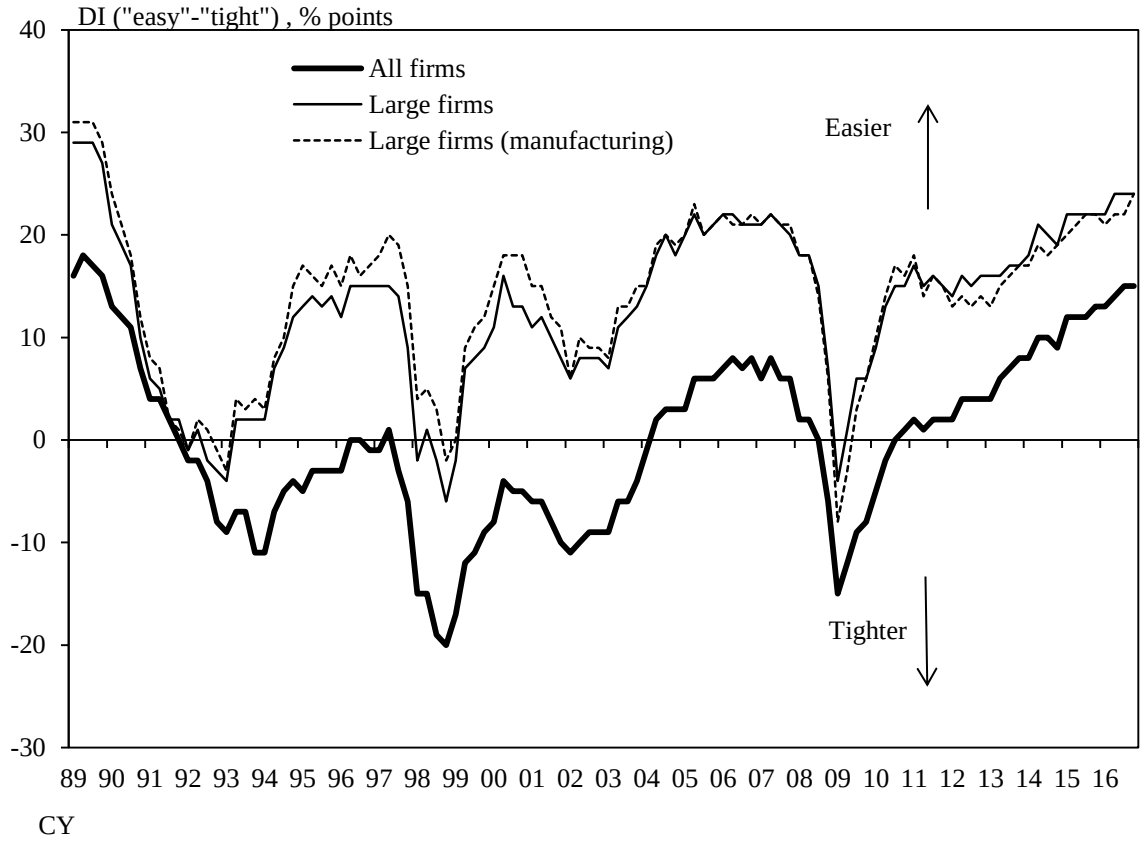
Note: Scattered plot of forecast errors of each firm for GDP growth and industry demand growth.Forecast error is calculated based on 1-year-ahead forecasts.

Figure 5 Corporate profits and business fixed investment



Notes: Average of corporate profits (thin line) and business fixed investment (thick line) across firms. Based on Ministry of Finance "Financial Statements Statistics of Corporations by Industry, Quarterly"; all industries and firm sizes but excluding the finance and insurance sector. Fixed investment excludes software investment.

Figure 6 Firms' assessments of funding conditions



Notes: Assessments of funding conditions reported by all firms (thick line), large firms (thin line), and large manufacturing firms (dotted line), respectively. The data is diffusion index, defined as the number of firms reporting "easy" minus the number of firms reporting "tight." Based on Bank of Japan "Short-term Economic Survey of Enterprises (TANKAN) ."