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Uncertainty in Long-Term Macroeconomic Forecasts: *Ex post* Evaluation of Forecasts by Economics Researchers*

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Abstract

This study presents an *ex post* evaluation of the accuracy of long-term macroeconomic forecasts made by economics researchers. The results indicate, first, that the economic growth and inflation forecasts for the next ten years are biased upward. Second, there are positive correlations between real gross domestic product (GDP) and total factor productivity (TFP) growth forecasts, and between nominal GDP growth and consumer price index (CPI) inflation forecasts, resulting in the same correlations between forecasting errors for these macroeconomic variables. Third, GDP growth forecasts by academic researchers in economics are less upwardly biased than those by professional forecasters in private institutes. However, the upward bias of academic researchers specializing in macroeconomics and economic growth is larger than those in the other research fields. These results indicate that long-term economic forecasting involves significant uncertainty, even for economists.

Keywords: economic forecast, forecast error, economic growth, productivity, inflation

JEL Classification: E17, E37, O47

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Uncertainty in Long-Term Macroeconomic Forecasts: *Ex post* Evaluation of Forecasts by Economics Researchers

1. Introduction

The accuracy of long-term macroeconomic forecasts substantially affects fiscal policies, such as ensuring the sustainability of government debt and the social security system. In Japan, for example, the Medium- to Long-term Economic and Fiscal Projections prepared by the Cabinet Office make several assumptions about the future growth of total factor productivity (TFP) and labor input, such as labor force participation rate and the number of immigrant workers, to estimate the future fiscal balance. In the long-term projections of the social security system, consumer price index (CPI) inflation, wage growth, and interest rates are assumed exogenously to estimate the future levels of social security contributions and benefits. However, long-term economic forecasts entail significant uncertainty; for one, the future developments of new innovations and their diffusion are difficult to assess quantitatively.[1] In addition, many unforeseeable events such as financial crises, international conflicts, and major natural disasters occur in reality.

Many studies have indicated that economic growth forecasts by government agencies, as well as those by the international organizations, tend to be biased upward (e.g., Jonung and Larch, 2006; Ashiya, 2007; Frankel, 2011; Frankel and Schreger, 2013, 2016; Merola and Perez, 2013; Pain *et al*., 2014; Chatterjee and Nowak, 2016). The upward bias in economic growth forecasts often causes optimistic bias in the projections of fiscal balance and debt level. Studies about professional forecasters have indicated that their forecasts also have an upward bias (e.g., Engelberg *et al*., 2009; Dovern and Jannsen, 2017) and that they underestimate future uncertainty (e.g., Giordani and Soderlind, 2003). Although many studies have evaluated economic forecasts by governments, international organizations, and professional forecasters, such studies have mostly focused on short-term forecasts of one or two years ahead.

A relatively small number of studies evaluating medium-term forecasts include Frankel (2011)

[1] In the recent empirical studies on uncertainty, *ex post* forecast error is frequently used as a proxy of uncertainty (e.g., Tulip, 2009; Bachmann *et al*., 2013; Arslan *et al*., 2015; Rossi and Sekhposyan, 2015; Knüppel, 2018; Morikawa, 2016, 2019, Tanaka *et al*., 2019).

and Frankel and Schreger (2013), which analyze three year forecasts of government agencies, and Ho and Mauro (2014), which analyzes five year forecasts of the IMF World Economic Outlook. These studies indicate that the optimistic bias tends to increase along with the time horizon of the forecasts. Frankel (2011), for example, finds that the mean upward bias in gross domestic product (GDP) forecasts across 33 countries at the one, two, and three year horizons are 0.4%, 1.1%, and 1.8%, respectively. [2] However, studies on the accuracy of long-term forecasts, such as those involving a ten year time horizon, have been scarce. In addition, as far as the author is aware of, there is yet to be done any study that evaluates macroeconomic forecasts of academic researchers in economics.

Against this background, this study presents new evidence on the accuracy of long-term macroeconomic forecasts by academic researchers in economics and professional forecasters in private institutes. Specifically, this study uses survey data on macroeconomic forecasts on real/nominal GDP growth, TFP growth, and CPI inflation rates made in the mid-2000s to evaluate the *ex post* performance of the ten year ahead forecasts.

The study finds that, first, the economic growth and inflation forecasts for ten years are biased upward. Second, there are positive correlations between the real GDP and TFP growth forecasts, and between the nominal GDP growth and CPI inflation forecasts, resulting in the same correlations between forecasting errors for these macroeconomic variables. Third, GDP forecasts by academic researchers in economics are less upwardly biased than those by professional forecasters in private institutes. However, the upward bias of academic researchers specializing in macroeconomics and/or economic growth are larger than those in other research fields.

The rest of this paper is organized as follows. Section 2 explains the survey data used in this study and the method of analysis. Section 3 presents the results and Section 4 summarizes the conclusions with the implications.

2. Data and Method

The survey data used in this study are taken from the Survey of Long-Term Outlook of the Japanese Economy designed by the author of this paper and conducted by the Ministry of

[2] Japan is not included in the sample of 33 countries.

Economy, Trade and Industry in 2006 and 2007.[3] The survey questionnaire was sent to around 3,000 researchers in economics belonging to the Japanese Economic Association (JEA) and to about 100 professional forecasters in private economic institutes who are not members of the JEA.[4] The survey collected information about the respondents' gender, age (10 years interval), affiliation (university, public research institute, private company and research institute, student, and others), and research field (19 JEL classifications). [5] A total of 171 responses were obtained in the 2006 survey and 437 in the 2007 survey. The distribution of respondents by individual characteristics is presented in **Table 1**. About 94% are members of the JEA and about 77% are professors/researchers belonging to universities.

The survey asked respondents to report their long-term forecasts on real/nominal GDP growth, TFP growth, and CPI inflation rates for the next 10 and 30 years. To be more specific, the survey asked the annualized rates (up to the first decimal point) of the variables based on an assumption that there will not be any huge exogenous shocks and policy changes. The question on TFP growth rate noted that production factors in calculating TFP include only labor (total hours) and capital, meaning that this value-added based TFP includes quality change in labor and capital.

In the 2006 survey, the actual growth rates in the immediately preceding 10 and 20 years were provided for reference. The actual rates in past 10 and 20 years provided in the 2006 survey were 1.1% and 2.2% for real GDP growth, 0.2% and 2.5% for nominal GDP growth, and -0.1% and 0.8% for CPI inflation rates. In the case of TFP, the actual TFP growth rates in the 1980s and 1990s (1.2% and 0.7%) were taken from the Annual Report on the Japanese Economy and Public Finance (FY2003) and provided in the survey question. In the 2007 survey, in addition to the actual rates, mean and median figures from the 2006 survey were provided for reference. The actual rates in past 10 and 20 years provided in the 2007 survey were 1.1% and 2.2% for real GDP growth, 0.1% and 2.2% for nominal GDP growth, and -0.1% and 0.6% for CPI inflation rates. The provided information on TFP was the same with the 2006 survey.

Since realized figures of the macroeconomic variables are currently available, *ex post* forecast errors or the accuracy for the ten year forecasts can be evaluated. The realized figures corresponding to the forecasts in 2006 are the means from fiscal years 2007 to 2016, and those

[3] The two surveys were conducted in February.
[4] The survey was conducted with cooperation and approval of the JEA. JEA is the counterpart of the American Economic Association in the United States.
[5] Field of research is multiple choice question. On average, about two fields were chosen by the respondents.

corresponding to the forecasts in 2007 are the means from fiscal years 2008 to 2017. The forecast errors are calculated as realized rates subtracted from the forecasted rates. Therefore, the positive (negative) figure means upward (downward) bias in the forecasts. Regarding GDP, the System of National Accounts at the time of the surveys was the 93SNA, which was replaced by the 08SNA in 2015. The 93 SNA series are available up to fiscal year 2014, but it is preferable to calculate forecast errors using the same series. In this study, the GDP data for fiscal year 2015 and thereafter are extrapolated using growth rates of the 08SNA series.

Contrary to GDP and CPI statistics, there is no single official figure for TFP growth rate. Since the survey asked for forecasts of the value-added TFP where labor (total hours) and capital were the production inputs, we take the TFP series consistent with this definition from the material in the Monthly Economic Survey published by the Cabinet Office.

However, as explained, the survey asked for forecasts based on an assumption of no huge exogenous shocks. The Global Financial Crisis from 2008 to 2009 should be treated as a huge exogenous shock on the Japanese economy. In this regard, we calculate the mean realized growth rates by removing figures for the fiscal years 2008 and 2009 and use these rates to calculate the alternative measures of forecast errors.

After constructing the data set, we pool the 2006 and 2007 survey data to observe the means and distributions of the forecasts. We then analyze the relationships among the forecasted variables. Specifically, we run simple ordinary least squares (OLS) regressions to explain the forecasts of real GDP growth rate ($RGDP^F$) by that of TFP growth rate (TFP^F) and survey year dummy (equation (1)), and to explain forecasts of nominal GDP growth rate ($NGDP^F$) by those of TFP growth rate and CPI inflation rate (CPI^F), and survey year dummy (equation (2)).

$$RGDP^F = \beta_0 + \beta_1 TFP^F + \beta_2 \text{ Year dummy} \quad (1)$$

$$NGDP^F = \beta_0 + \beta_1 TFP^F + \beta_2 CPI^F + \beta_3 \text{ Year dummy} \quad (2)$$

Next, we analyze the relationships between respondents' individual characteristics and forecast errors. Specifically, we run OLS regressions to explain forecast errors by gender, age, membership in the JEA, the research field, and survey year dummy (equation (3)). Among the 19 fields in the JEL classification, we construct a dummy for those who chose macroeconomics and/or economic growth (expressed simply as "Macroeconomics"). This dummy represents those who chose

"Macroeconomics and Monetary Economics" and/or "Economic Development, Technological Change, and Growth" as their research field, and who comprise 41% (249 responses) of the sample. Our interest is whether or not those who specialize in macroeconomics present more accurate forecasts.

$$\begin{aligned} \textit{Forecast error} = {} & \beta_0 + \beta_1 \textit{Female} + \beta_2 \textit{Age} + \beta_3 \textit{JEA} \\ & + \beta_4 \textit{Macroeconomics} + \beta_5 \text{Year dummy} \end{aligned} \tag{3}$$

3. Results

3.1. Overview of the long-term economic forecasts

Table 2 summarizes the means, medians, and standard deviations of the forecasts for the next 10 and 30 years. The real and nominal GDP growth forecasts are lower for the next 30 years than for the next 10 years. As the TFP growth forecasts are almost the same by the time horizon, the different GDP growth forecasts can be interpreted as reflecting different views on future trends in working population (labor input) and capital accumulation. The CPI inflation rate forecast is higher for the next 30 years than for the next 10 years, but the figures are both around 1%, with only a small difference. We can calculate the implied GDP deflator forecasts of respondents by subtracting real GDP growth forecast from nominal GDP growth forecast. The GDP deflator forecasts are 0.6-0.7% for the next 10 years and 0.8% for the next 30 years. These rates are about 0.3% point lower than the CPI inflation forecasts. Since GDP deflator covers not only consumption goods/services but also investment goods/services, the inflation rate of which is generally lower than consumption goods/services, the low GDP deflator forecasts relative to the CPI forecasts is consistent with recent experience. [6] For all variables, the dispersion of forecasts is larger for the next 30 years than for the next 10 years (column (3)), indicating that forecasts for longer time horizon involve greater disagreement.[7]

[6] For example, the annual CPI inflation rate between fiscal year 1994 and 2018 was 0.16% and the rate for GDP deflator was -0.66%.

[7] Cross-sectional disagreement of individual forecasts is correlated with macroeconomic uncertainty (Dovern *et al*., 2012) and is sometimes used as a proxy of uncertainty (e.g., Bomberger, 1996; Giordani and Soderlind, 2003; Bachmann *et al*., 2013).

Table 3 presents the correlation coefficients among the forecasted macroeconomic variables. The correlations between real GDP and TFP growth rates are about 0.5-0.6 and the correlation between nominal GDP growth and CPI inflation rates are also about 0.5-0.6, both of which are relatively high. Those who anticipate higher productivity growth tend to forecast higher real economic growth, and vice versa. Similarly, those who anticipate higher inflation rates tend to forecast higher nominal economic growth rates, and vice versa. These associations among variables are theoretically consistent with each other.[8]

In contrast, the correlation coefficients between TFP growth and CPI inflation forecasts are about 0.1-0.2, indicating that these two forecasts are almost independent. Recently, the influential argument has been that accelerating productivity growth is essential to attain 2% inflation target. Ten years ago, such an idea was not shared by professional economists.

As expected, irrespective of the variables, the correlations between 10 and 30 year forecasts are around 0.7. Those who anticipate higher growth rates for the next 10 years tend to forecast higher rates for the next 30 years.

The regression results to explain real/nominal GDP growth forecasts by TFP and CPI forecasts (equations (1) and (2)) are presented in **Table 4**. In the estimations for real GDP growth forecasts, the coefficients for TFP forecast are about 0.6 and 0.7 for 10 and 30 year forecasts, respectively, and significant at the 1% level (columns (1) and (2)). The result confirms that the forecast for productivity is strongly associated with real economic growth forecast. However, the size of the coefficient can exceed unity because growth of capital stock, which is an endogenous variable in the long-run, should have a positive correlation with TFP growth. In this regard, the estimated cross-sectional coefficients for TFP forecasts are smaller than the theoretically expected size.

In the estimations for nominal GDP growth forecasts, the coefficients for TFP and CPI forecasts are both positive and significant at the 1% level (columns (3) and (4)). Those who anticipate higher long-run productivity growth and inflation rates predict higher forecasts for nominal economic growth rate, and vice versa. The estimated coefficients for CPI forecasts are larger than those for TFP forecasts. The size of the coefficients for CPI forecasts are about 0.7-0.8. Since the growth rate of GDP deflator, which includes investment goods and services, is generally lower than the CPI inflation rate, the estimated cross-sectional coefficients for CPI forecasts less than

[8] Correlations among forecast error of the variables can be calculated for the 10 year forecasts. By construction, the correlation coefficients are the same with those for the forecasts of the variables.

unity are reasonable.[9]

To summarize, the relationships among forecasted macroeconomic variables made by professional economists are generally consistent with each other.

3.2. *Ex post* evaluation of the forecast accuracy

Table 5 summarizes the *ex post* forecast errors for the 10 year forecasts. The realized annual growth rates for fiscal years 2006-2016 are 0.38% for real GDP, -0.04% for nominal GDP, 0.73% for TFP, and 0.29% for CPI. The figures for fiscal years 2007-2017 are 0.39%, 0.08%, 0.72%, and 0.32%, respectively. The forecast error for real GDP growth is about 1.3% points at the mean and about 1.4% points at the median, indicating that the forecasts by researchers in economics have large upward bias (column (1)). The bias is larger for nominal GDP growth rate: about 2.3% points at the mean and about 2.4% points at the median. The forecast error for TFP growth is relatively small: about 0.5% point at the mean and about 0.3% point at the median. This table also presents the root mean square error (RMSE). Given that the number of downward biased forecasts is very small, the figures are similar to the simple forecast errors.

In comparison with the growth forecasts, the forecast error for CPI inflation rate is not so large: the upward bias is about 0.6% point at the mean and about 0.7% point at the median. The forecast error for the implied GDP deflator is about 0.8-1.0% points, which are larger than those for the CPI forecast. This result suggests that researchers in economics may underestimate the decline in relative prices of investment goods/services, resulting in larger upward bias in nominal GDP forecast.

Figure 1 depicts the distribution of real and nominal GDP growth forecast errors. Obviously, forecast errors for nominal GDP growth is distributed in a larger side than real GDP growth forecast errors. There is great heterogeneity among professional economists and a small number of them exhibit negative forecast errors (downward biased forecasts). In the case of real GDP forecast errors, there are three peaks in the distribution, reflecting that forecasts are concentrated at 1.0%, 1.5%, and 2.0%. On the other hand, the distribution of nominal GDP growth forecast

[9] When forecasts for implied GDP deflator are regressed on CPI inflation forecasts, the coefficients for CPI forecasts are about 0.6.

errors is close to the normal distribution.

The distribution of inflation forecast errors are depicted in **Figure 2**. In addition to the CPI forecast errors, forecast errors for the implied GDP deflator are also depicted in the table. Both of these distributions exhibit two distinct peaks, reflecting that a relatively large number of respondents forecast 0.5% and 1.0% annual inflation rates. The distribution of forecast errors of the implied GDP deflator are located on the larger side. Inflation forecast errors are also very heterogeneous among the economics researchers; a small number of them exhibit negative forecast errors (downward biased forecasts).

As explained in the previous section, the survey asked for forecasts based on an assumption of no huge exogenous shocks and policy changes. In order to correct the impact of the Global Financial Crisis on the accuracy of forecasts, column (2) of **Table 5** presents forecast errors by removing realized growth rates for fiscal years 2008 and 2009. After excluding fiscal years 2008 and 2009, the realized annual growth rates for fiscal years 2006-2016 are 1.22% for real GDP, 0.95% for nominal GDP, 0.76% for TFP, and 0.45% for CPI. The figures for fiscal years 2007-2017 are 1.23%, 1.10%, 0.75%, and 0.48%, respectively. Obviously, irrespective of the variables, the mean and median forecast errors become smaller than the uncorrected figures in column (1), confirming that the unexpected shock to the global economy significantly impacted the measured forecast errors.

However, even after removing the two years affected by the Global Financial Crisis to calculate annual growth rates, a non-negligible upward bias remains: about 0.5-0.6% point for real GDP growth and about 1.3-1.4% points for nominal GDP growth. Forecasts by the researchers in economics have optimistic bias, similar to the findings for the forecasts by the government agencies and international organizations. Why are economic researchers' growth forecasts upward biased? Although it is difficult to determine from the data, a possible interpretation is that the respondents tend to extrapolate the past growth performance. Another possibility is that the actual economic policies conducted by the government were inappropriate relative to the respondents' expectation. The forecast errors in the CPI inflation rate is about 0.4-0.5% point and that in the implied GDP deflator is about 0.8% point, suggesting that a large number of researchers did not anticipate prolonged deflation or a continuously low inflation rate.

Finally, **Table 6** presents regression results to explain forecast errors by individual characteristics (equation (3)). The figures in this table are based on the realized ten year growth rates without removing the observations for fiscal years 2008 and 2009. It should be noted that

regardless of the impact of the Global Financial Crisis, the estimated coefficients for the individual characteristics are not affected. [10]

The coefficients for the JEA dummy are negative and significant at the 1% level in real and nominal GDP growth forecast errors (columns (1) and (2)). Although the size of the coefficients is not large, the upward bias is about 0.2-0.3% point smaller for forecasts by academic researchers than by professional forecasters from private institutes (non-members of the JEA). In contrast, the coefficients for the dummy for researchers in macroeconomics are positive and significant in real and nominal GDP and TFP growth forecast errors.[11] When using the subsample of the JEA members, the coefficients for the dummy are almost the same (**Table 7**). The long-term economic forecasts by the researchers specialized in macroeconomics and/or economic growth are not necessarily accurate, although the differences are quantitatively small (about 0.2% point). Why are their forecasts relatively inaccurate? One possible reason is that they were frequently faced with information about the statistics of high growth rates and the government's economic outlook at the time of forecasting.

The difference by individual characteristics is not found in the CPI inflation forecast error (column (4)). While not explicitly reported in the table, the differences by gender are statistically insignificant. The dummies for age categories are sometimes significant, but no systematic pattern by age was evident.

4. Conclusion

This study presents evidence on the accuracy of long-term macroeconomic forecasts by academic economists and professional forecasters in private institutes. Specifically, this study

[10] Since the negative forecast errors (downward biased forecasts) are very small, the regression results using absolute forecast errors as dependent variables are similar to those reported in the table.

[11] When dummies for the 19 JEL classifications are included in the regression to explain the forecast errors in real GDP growth, dummies for the other fields are mostly insignificant. The sole exception is the dummy for "Labor and Demographic Economics," in which the estimated coefficient is negative and marginally significant (10% level). When the same specification is applied to the forecast errors in nominal GDP growth and CPI inflation, the dummy for "Agricultural and Natural Resource Economics; Environmental and Ecological Economics" is negative and statistically significant.

uses survey data on macroeconomic forecasts on real/nominal GDP growth, TFP growth, and CPI inflation rates to evaluate the *ex post* performance of the ten year forecasts by comparing them with the realized rates of these variables.

The results can be summarized as follows. First, the GDP and inflation forecasts for the next ten years are biased upward, even after adjusting for the unforeseeable impact from the Global Financial Crisis. Second, there are positive correlations between real GDP and TFP growth forecasts, and between nominal GDP growth and CPI inflation forecasts, resulting in similar correlations between forecasting errors for these macroeconomic variables. Third, GDP forecasts by the academic researchers in economics are about 0.2-0.3% point less upwardly biased than those by the professional forecasters in private research institutes who are not members of the JEA. However, the upward bias of academic researchers specialized in macroeconomics and/or economic growth are larger than those in other research fields by about 0.2% point.

These results indicate that long-term macroeconomic forecasts involve significant uncertainty, even for economists, and that upward bias in future productivity growth and inflation rates can be a cause for the bias in GDP growth forecasts. However, since this study relies only on the two surveys conducted in the mid-2000s, we should be cautious in generalizing the results.

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Table 1. Characteristics of the Respondents

Characteristics		%
JEA member		93.6%
Age	20-29	2.5%
	30-39	24.2%
	40-49	23.7%
	50-59	26.7%
	60-69	15.7%
	70 or older	7.2%
Gender	Male	93.3%
	Female	6.7%
Affiliation	University	76.8%
Research field	Macroeconomics	31.7%
	Economic growth	13.3%

Notes: Tabulated from the pooled data of the 2006 and 2007 surveys. N=608.

Table 2. Means, Medians, and Standard Deviations of Forecasts

	(1) Mean		(2) Median		(3) Standard deviation	
	10 years	30 years	10 years	30 years	10 years	30 years
$RGDP^F$	1.71	1.24	1.80	1.20	0.62	0.84
$NGDP^F$	2.36	2.08	2.50	2.00	0.91	1.20
TFP^F	1.23	1.08	1.00	1.00	0.55	0.67
CPI^F	0.91	1.14	1.00	1.00	0.63	0.82
$Deflator^F$	0.65	0.83	0.50	0.80	0.66	0.85

Notes: The figures are annual rates. The forecast of GDP deflator is calculated by subtracting real GDP growth forecast from nominal GDP growth forecast at the individual level.

Table 3. Correlation Coefficients among Forecasted Variables

	$RGDP^F$ (10 years)	$RGDP^F$ (30 years)	$NGDP^F$ (10 years)	$NGDP^F$ (30 years)	TFP^F (10 years)	TFP^F (30 years)	CPI^F (10 years)	CPI^F (30 years)
$RGDP^F$ (10 years)	1.000							
$RGDP^F$ (30 years)	0.627	1.000						
$NGDP^F$ (10 years)	0.695	0.497	1.000					
$NGDP^F$ (30 years)	0.548	0.697	0.715	1.000				
TFP^F (10 years)	0.507	0.382	0.353	0.310	1.000			
TFP^F (30 years)	0.353	0.596	0.272	0.453	0.683	1.000		
CPI^F (10 years)	0.187	0.204	0.511	0.396	0.128	0.158	1.000	
CPI^F (30 years)	0.256	0.246	0.471	0.603	0.165	0.196	0.713	1.000

Table 4. Regression Results to Explain GDP Growth Forecasts

	(1) $RGDP^F$ (10 year)	(2) $RGDP^F$ (30 year)	(3) $NGDP^F$ (10 year)	(4) $NGDP^F$ (30 year)
TFP^F	0.5822 ***	0.7260 ***	0.4854 ***	0.6348 ***
	(0.0482)	(0.0535)	(0.0650)	(0.0821)
CPI^F			0.6918 ***	0.7780 ***
			(0.0761)	(0.0763)
Constant	1.0052 ***	0.4700 ***	1.1711 ***	0.5217 ***
	(0.0662)	(0.0632)	(0.1015)	(0.1064)
Year dummy	yes	yes	yes	yes
R^2	0.2669	0.3225	0.3561	0.4804
Nobs.	530	521	522	513

Notes: OLS estimations with robust standard errors in parentheses. ***: p<0.01.

Table 5. Means, Medians, and RMSEs of Forecast Errors

	(1) Uncorrected			(2) Corrected		
	Mean	Median	RMSE	Mean	Median	RMSE
$RGDP^F$	1.32	1.41	1.46	0.49	0.58	0.79
$NGDP^F$	2.31	2.42	2.48	1.30	1.40	1.59
TFP^F	0.51	0.28	0.75	0.48	0.25	0.73
CPI^F	0.59	0.68	0.87	0.43	0.52	0.77
$Deflator^F$	0.99	0.93	1.19	0.82	0.79	1.05

Notes: Calculated from the pooled data of the 2006 and 2007 surveys. Corrected figures in column (2) use realized rates by removing fiscal years 2008 and 2009. The forecast of GDP deflator is calculated by subtracting real GDP growth forecast from nominal GDP growth forecast at the individual level.

Table 6. Individual Characteristics and Forecast Errors

	(1) *RGDP forecast error*	(2) *NGDP forecast error*	(3) *TFP forecast error*	(4) *CPI forecast error*
JEA member	-0.2475 ***	-0.3419 ***	0.0271	-0.0821
	(0.0738)	(0.1265)	(0.0650)	(0.0823)
Macroeconomics	0.1996 ***	0.1486 *	0.1122 **	0.0274
	(0.0534)	(0.0815)	(0.0483)	(0.0574)
Gender	yes	yes	yes	yes
Age	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes
R^2	0.0545	0.0319	0.0347	0.0269
Nobs.	546	539	520	541

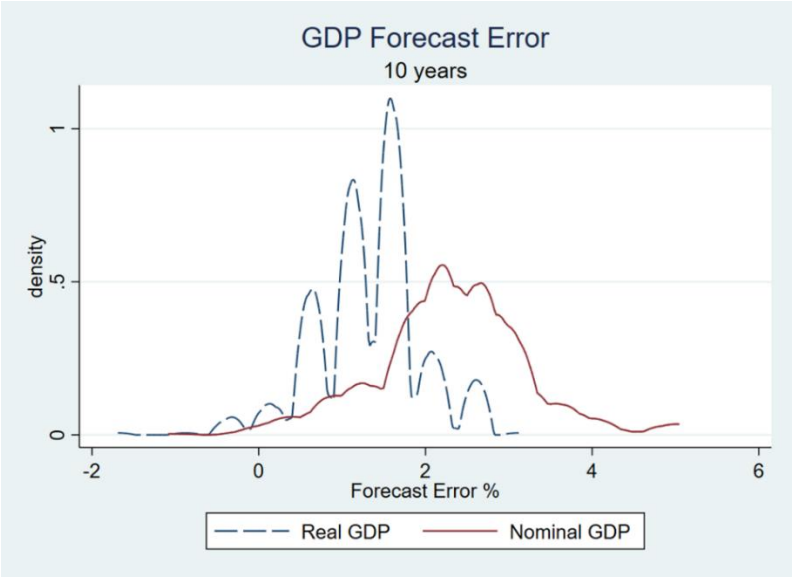
Notes: OLS estimations with robust standard errors in parentheses. ***: $p<0.01$, **: $p<0.05$, *: $p<0.1$.

Table 7. Individual Characteristics and Forecast Errors (JEA Members only)

	(1) *RGDP forecast error*	(2) *NGDP forecast error*	(3) *TFP forecast error*	(4) *CPI forecast error*
Macroeconomics	0.2074 ***	0.1611 *	0.1161 **	0.0237
	(0.0565)	(0.0858)	(0.0514)	(0.0606)
Gender	yes	yes	yes	yes
Age	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes
R^2	0.0497	0.0291	0.0357	0.0298
Nobs.	508	501	482	503

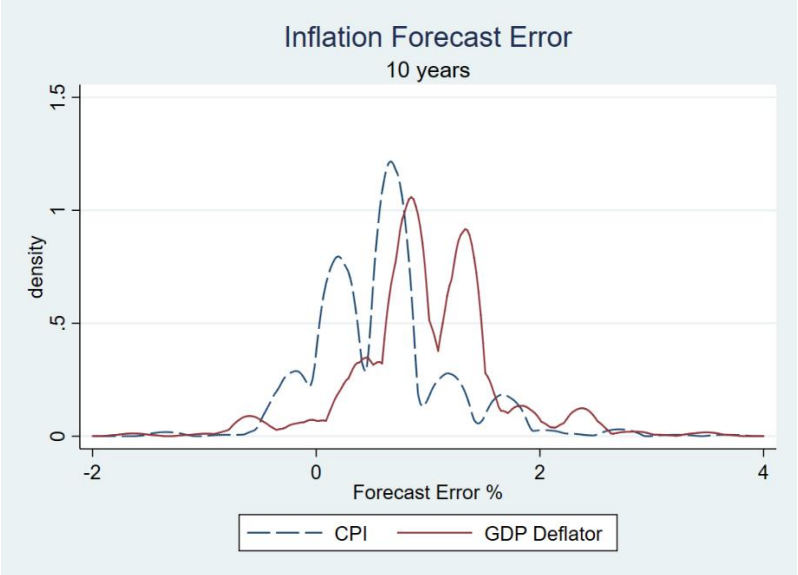
Notes: OLS estimations with robust standard errors in parentheses. ***: p<0.01, **: p<0.05, *: p<0.1.

Figure 1. Distributions of the GDP Growth Forecast Errors



Note: Depicted from the pooled data of the 2006 and 2007 surveys.

Figure 2. Distributions of the Inflation Forecast Errors



Notes: Depicted from the pooled data of the 2006 and 2007 surveys. The forecast of GDP deflator is calculated by subtracting real GDP growth forecast from nominal GDP growth forecast at the individual level.