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Assessing macroeconomic forecasts for Japan under an asymmetric loss function

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ABSTRACT

This paper examines the asymmetry of the loss functions of the Japanese government, the International Monetary Fund (IMF), and private forecasters for Japanese output growth and inflation forecasts. It tests the rationality of the forecasts, assuming a possibly asymmetric loss function. The results indicate considerable evidence of asymmetry. The 15-month forecasts are overpredicted, irrespective of forecaster identity or the target variable. However, the biases in the three-month forecasts vary among forecasters: the IMF provides prudent short-term forecasts for output growth and inflation, while private forecasters provide unbiased inflation forecasts. The government uses the information provided in the IMF and consensus forecasts efficiently when making its own forecasts. A comparison with the projections for the German economy indicates that the biases of the Japanese government may be attributable to its debt-to-GDP ratio, which is the highest among advanced economies.

1. Introduction

Recent studies on budget forecasting have attracted considerable attention (e.g., Chatagny & Soguel, 2012; Frankel, 2011) because many countries, both advanced and developing, face large outstanding debts. In particular, several European Union (EU) member states have an urgent need to resolve serious sovereign debt issues. Tackling these problems is crucial not only for the country facing the debt, but also for the rest of the EU member states, so as to ensure the stability of the currency union.

Japan's debt-to-GDP ratio is a serious concern for the country, being the highest among the advanced economies. Although Japan is not a member of any currency union, the Japanese sovereign debt crisis could have a much greater impact than the recent crises in Greece and other peripheral countries. Currently, Japan is facing large government deficits, and its public debt is growing rapidly. In the fiscal year 2011, the deficit was −8.9% of the GDP, and the debt-to-GDP ratio was 210.6%.[1] The corresponding figures for Germany, which is one of the handful of countries that have maintained sustainable levels, were −0.8% and 86.3%, respectively. Many observers worry that Japan's debt-to-GDP ratio is unsustainable; thus, a considerable amount of effort has been devoted to the examination of Japan's fiscal issues. These efforts have focused mainly on fiscal sustainability (Broda & Weinstein, 2005; Hubbard & Ito, 2006), increases in the fiscal deficit, and the accumulation of government debt (Asako, Ito, & Sakamoto, 1991; Doi & Ihori, 2002; Ihori, 2006; Ihori, Doi, & Kondo, 2001; Ihori, Nakazato, & Kawade, 2003).

Fig. 1 illustrates Japan's debt-to-GDP ratio and the Japanese government's forecast errors (actual value − forecast value) for real and nominal GDP growth,

[1] For example, other countries' deficit ratios were −9.6% for Greece, −4.1% for the EU, and −6.4% for all members of the Organization for Economic Co-operation and Development (OECD). The debt-to-GDP ratios were 178.9% for Greece, 95.6% for the EU, and 103.5% for all OECD members (OECD Economic Outlook No. 93).

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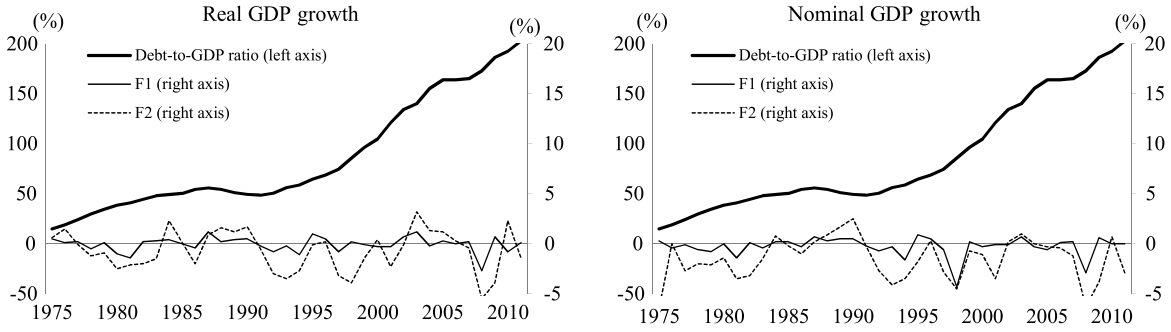

Fig. 1. Debt-to-GDP ratio and forecast errors.

respectively. It provides a rough picture of the relationship between periods with large negative forecast errors and those with large increases in the debt-to-GDP ratio.[2] For certain periods between 1990 and early 2000, large negative forecast errors are associated with rapid increases in the debt-to-GDP ratio. This suggests that the overprediction of output growth might result in an increase in the debt-to-GDP ratio. In contrast, there are periods between the mid-1980s and 1990 that show positive forecast errors being associated with stagnant or decreasing debt-to-GDP ratios. This underscores the significance of the government's behavior in making output forecasts. Note that there is a large difference in forecast errors (for the 15-month forecast, F2, seen in Fig. 1) between real and nominal GDP growth in 2003; the forecast error for real GDP growth is a large positive value, while that for nominal GDP growth is around zero. This suggests that there may be a closer relationship between the debt-to-GDP ratio and nominal GDP, because underprediction did not lead to a decrease in the former.

Therefore, this paper examines the asymmetry of the loss functions of the Japanese government, the International Monetary Fund (IMF), and private forecasters for the forecasts of Japanese output growth and inflation, and aims to draw implications regarding macroeconomic forecasts of Japan's debt-to-GDP ratio. First, in line with the method developed by Elliott, Komunjer, and Timmermann (2005), I evaluate the loss functions in macroeconomic forecasts for the Japanese economy, because these forecasts are crucial inputs for fiscal forecasting. Moreover, as there are differences in forecast errors (namely overprediction and underprediction), the forecast estimates could be biased either upward or downward, based on an asymmetric loss function. Second, I compare the biases in the Japanese government's forecasts with those of the IMF and private forecasters. Previous studies have focused on only one forecaster at a time, whether intergovernmental agencies, central banks, or private forecasters. Döpke, Fritsche, and Siliverstovs (2010) evaluated the inflation and real growth forecasts of various forecasters for Germany, including the German government, the IMF, and private forecasters. Furthermore, the nominal GDP growth, which was not examined by Döpke et al. (2010) and has been relatively overlooked in the forecast evaluation literature, is investigated in this paper as well, because it is one of the simplest indicators of income for a given country, and can serve as a proxy for tax revenues.[3] Indeed, it is one of the main variables examined in sovereign debt sustainability analyses (e.g., Leal, Perez, Tujula, & Vidal, 2008).

Third, I investigate whether the Japanese government incorporates the forecast information provided by the IMF and private forecasters into its forecasts; if these forecasts are not used efficiently by the government when it is making its own forecasts, this implies that there is room for improvement in the Japanese government's forecasts.

Finally, by comparing these results with those of the German forecasts,[4] I examine the relationships between the biases in the economic and deficit forecasts for Germany and Japan. Although this appears to be a mere comparison of two countries, these differences could help explain the factors that caused Japan's rapid accumulation of debt. Although a few studies – such as that of Maekawa and Fukushige (2012) – have analyzed the relationship between the Japanese government's economic and budget forecasts, a comparison of the cases of Japan and Germany enables us to clarify these differences and uncover the principal drivers of Japan's unexpected and rapid accumulation of debt.

The results show considerable evidence of asymmetry. The 15-month forecasts are all overpredicted, irrespective of the forecasting identities and target variables. However, the biases in the three-month forecasts vary among the forecasters. The IMF provides prudent short-term forecasts for output growth and inflation, and private forecasters provide unbiased inflation forecasts. Conversely, the biases in the government's real GDP growth output forecasts are mixed, while those in the inflation forecasts are

[2] However, further investigation along these lines is outside the scope of this paper.

[3] It has been observed widely that tax revenues respond to both growth in income and economic growth. However, tax outlays are tied closely to administrative and legislative systems, and thus, the relationship with macroeconomic variables seems weaker. Because we examine inflation as well as the nominal GDP, some aspects of tax outlays can be inferred, given that government spending is tied to inflation to some extent. Therefore, the approach used in this paper can be considered as a first approximation for obtaining information on budget forecasts. Tsuri (2005) indicated that two-thirds of Japan's deficit in the 1990s was caused by factors on the revenue side.

[4] The German and Japanese economies appear to share the characteristic of being export-led.

broadly overpredicted. The Japanese government uses the information provided in the IMF and private forecaster forecasts efficiently when making its forecasts. I also find evidence of rationality under an asymmetric loss function.

These findings have two main implications. First, biases in economic forecasts are likely to have played a crucial role in Japan's rapid accumulation of high levels of debt. Second, these biases could be attributed to the complicated politico-institutional process of producing economic and budget forecasts within government agencies; thus, establishing an independent organization that is responsible for these projections may be one possible solution.

The rest of the paper is organized as follows. Section 2 describes the data, with a brief review of related studies. Section 3 introduces the statistical approach. Section 4 presents the results, and investigates the information efficiency of the Japanese government's forecasts. Section 5 discusses the implications of these findings for Japan's fiscal forecasting and its consequent debt accumulation. Finally, Section 6 concludes the paper.

2. Data and related studies

I use three different sources for the forecast data: the Japanese government, the IMF, and the forecasts provided in *Consensus Forecasts*. For the actual outcomes, I refer to the data released one year after the initial forecasts were published (Batchelor, 2001).

2.1. Government forecasts

Each December, the Japanese government publishes forecasts of important economic variables for both the ongoing year and the next fiscal year.[5] I refer to these as the three-month (F1) and 15-month (F2) forecasts, respectively. In these forecasts, I examine the real GDP growth, nominal GDP growth, and inflation measured by consumer prices (CPI). The real GDP growth and inflation have been investigated extensively in the forecast evaluation literature. Furthermore, I also examine the nominal GDP growth because of its relevance to fiscal forecasting. In the economic forecasts, the nominal GDP, which is a broad measure of the income earned in a country, can be considered to be related the most closely to tax receipts, because tax revenues are a nominal variable and can be captured roughly by multiplying income with tax rates. The sample covers the period from fiscal 1975 to fiscal 2011.

Table 1 shows the error statistics[6] of the mean absolute error (MAE) and the root mean squared error (RMSE). It indicates that the government forecasts are broadly worse than those of the consensus forecasts according to these error metrics, and indistinguishable from those of the IMF forecasts. In particular, the error metrics for real GDP growth are similar to those of the IMF forecasts. For nominal GDP growth, the F1 values of the government forecasts are more accurate than those of the IMF forecasts, whereas the F2 values are similar. For inflation, the F2 values of the government forecasts are less accurate than those of the IMF forecasts, whereas the F1 values are similar.

Table 1
Forecast errors.

	Government		IMF		Consensus	
	F1	F2	F1	F2	F1	F2
Real GDP growth						
MAE	0.5	1.7	0.5	1.5	0.4	1.3
RMSE	0.7	2.1	0.7	2.0	0.6	1.9
Nominal GDP growth						
MAE	0.6	2.0	1.1	2.0	–	–
RMSE	1.0	2.6	1.7	2.7	–	–
Inflation						
MAE	0.2	1.3	0.3	0.6	0.1	0.4
RMSE	0.3	1.7	0.4	0.7	0.1	0.6

Many studies have reported optimism in government forecasts. Recent work by Frankel (2011) focused on government budget balance forecasts for the most advanced countries, and found them to be too optimistic. However, Frankel's (2011) analysis did not include Japanese data. Ashiya (2007) showed that the year-ahead real GDP forecast by the Japanese government was too optimistic. For the United States, however, Belongia (1988) showed that the forecasts from the Congressional Budget Office (CBO) exhibited no discernible bias. Likewise, Blackley and DeBoer (1993) found no evidence of bias in the economic forecasts from the Office of Management and Budget (OMB).

Pierdzioch, Rülke, and Stadtmann (2012) examined the economic forecasts of the Bank of Canada using an approach similar to that used in this paper. Capistrán (2008) assessed bias in the US Federal Reserve's inflation forecasts; and Döpke et al. (2010) investigated the German government's economic forecasts.

2.2. IMF forecasts

The IMF releases its forecasts for the current and following calendar years in the *World Economic Outlook*, which is published in April and September.[7] The April publication contains eight-month and 20-month forecasts. The September publication contains three-month (F1) and 15-month (F2) forecasts. F1 and F2 are comparable to the Japanese government's forecasts, since the forecast horizons are almost equivalent, although the target calendar years differ. The sample covers the calendar years 1984–2011. I examine the same set of variables as for the Japanese government forecasts.

There are two main categories of studies of forecasts by intergovernmental agencies, including the IMF, the Organization for Economic Cooperation and Development (OECD), and the European Commission (EC).

The first category of studies focuses on their performances relative to those of private forecasters. Batchelor (2001) compared the accuracy and information content of

[5] For example, fiscal 2010 spans the period from April 2010 to March 2011.

[6] Summary statistics and figures for all actual values and forecasts are available from the author upon request.

[7] Several publications are also released in May and October.

economic forecasts for G7 countries from the IMF and the OECD with those from private forecasters, and found the latter to be less biased and more accurate. Blix, Wadefjord, Wienecke, and Adahl (2001) concluded that the IMF forecasts might be ranked in the bottom half for both real GDP growth (12th out of 20) and CPI (16th out of 19). Table 1 indicates that the IMF forecasts are less accurate than the consensus, which supports previous findings in the literature.

The second category of studies focuses on the political economy of intergovernmental agencies. Dreher, Marchesi, and Vreeland (2008) and Musso and Phillips (2002) investigated IMF forecasts with the aim of identifying the politico-institutional determinants of their forecast errors and biases. Artis and Marcellino (2001) explored the loss functions of the IMF, OECD, and EC as a possible explanation for their respective biases.

Similarly to the approach used in this paper, Christodoulakis and Mamatzakis (2008, 2009) investigated the EC's economic forecasts. Christodoulakis and Mamatzakis (2008) showed that most member states exhibit prudential asymmetric loss functions for current-year forecasts, and most also maintain the same loss functions for year-ahead forecasts. However, Christodoulakis and Mamatzakis (2009) discovered that the loss functions of economic forecasts, including inflation, current account, government balances, unemployment, and investment, tend to exhibit optimism. Elliott et al. (2005) concluded that the IMF and OECD systematically overpredict government budget deficits. In particular, for Japan, IMF forecasts[8] showed that both the current-year and the one-year-ahead forecasts overpredict the government budget deficit. This result is consistent with reality, given that intergovernmental agencies penalize underpredictions more heavily than overpredictions, due to their political standpoint of needing to give prudent advice.

2.3. Consensus forecasts

Every month, Consensus Economics, the world's leading international economic survey organization, surveys more than 700 private financial and economic forecasters to obtain their estimates of key macroeconomic variables,[9] including real GDP growth and inflation. Consensus Economics' publications include forecasts by Japanese private forecasters for the current and following calendar years. There are about 20 individual private forecasters. The consensus, defined as the arithmetic mean for a variable, has been being published every year since 1989. To match the forecast horizons of the consensus forecasts with those of the IMF, I employ the forecasts from the September publications,[10] and denote them F1 and F2.

However, only a limited number of individual private forecasters participated throughout the entire sample period. Furthermore, some of the participating institutions merged during the period. To deal with these problems, I follow Elliott, Komunjer, and Timmermann (2008) by requiring each forecaster to have participated for a minimum of 20 yrs. Imposing this requirement leaves us with seven individual forecast series for real GDP growth and six individual series for inflation. See the Appendix for details on data construction.

The consensus is not examined[11] in this study, although it has been investigated widely in the literature and shown to perform relatively well compared to individual forecasts. Table 1 confirms that the accuracy of the individual forecasts seems to be higher than those of the other forecasts.

There is a considerable body of literature on private forecasters. Batchelor (2007) provided a noteworthy review of the various hypotheses while focusing on forecast biases among G7 countries. Lamont (2002), Laster, Bennett, and Geoum (1999), and Pons-Novell (2003) examined the strategic behaviors of private sector forecasters. For private forecasts in Japan, Ashiya (2005, 2009, 2010) examined issues relating to accuracy, strategic bias, and the rationality of Japanese private forecasts. Loungani (2001) evaluated a large number of private sector forecasts of real GDP growth in industrialized and developing countries.

Similarly to the approach used in this paper, Tsuchiya (2012) examined Japanese corporate executives' output forecasts and showed that their loss functions tend to produce optimistic forecasts. Döpke et al. (2010) examined private forecasts for Germany and found that asymmetry is observed in only a few cases. Krüger and Hoss (2012) examined economic forecasts for Germany and showed evidence of symmetries in the loss functions of output and inflation forecasts. Elliott et al. (2008) investigated the Survey of Professional Forecasters (SPF) and demonstrated that output growth forecasts exhibit overprediction and inflation forecasts exhibit underprediction.

3. Statistical method

Elliott et al. (2005) proposed the following general loss function:

$$L = [\alpha + (1 - 2\alpha) \cdot I\,(y_{t+1} - f_{t+1} < 0)] \cdot |y_{t+1} - f_{t+1}|^p\,, \tag{1}$$

where y_{t+1} is the realization of the variables of interest, f_{t+1} is the forecast of the variables of interest based on an information set Ω_t, I denotes the indicator function, $p = 1$ for a lin–lin loss function, $p = 2$ for a quad–quad loss function, $\alpha \in (0, 1)$ governs the asymmetry of the loss function, and p controls the degree of curvature. I focus on the quad–quad loss function, since it is closely related to mean squared errors (MSEs), which have well-behaved features and have been used extensively in the literature (Elliott et al., 2008).

[8] Note that, unlike in this paper, Elliott et al. (2005) did not investigate the OECD forecast for Japan because they only had access to forecasts of real GDP growth.

[9] Forecasts of nominal GDP growth were not available.

[10] The surveys are usually conducted on the 12th of each month, which precedes the publication of the *World Economic Outlook*.

[11] An examination of the consensus as an individual forecast series assumes that the individual forecasters have identical loss functions, even though the assumption is unlikely ever to be met.

Table 2
Estimates of the asymmetry parameter α: Government forecasts.

	F1						F2					
	Real GDP		Nominal GDP		Inflation		Real GDP		Nominal GDP		Inflation	
Model 1	0.58	(0.039)	0.73	(0.037)	0.59	(0.038)	0.70	(0.031)	0.94	(0.013)	0.88	(0.024)
Model 2	0.55*	(0.035)	0.70	(0.030)	0.56*	(0.036)	0.72	(0.030)	0.93	(0.010)	0.67	(0.035)
Model 3	0.57*	(0.035)	0.75	(0.031)	0.60	(0.031)	0.84	(0.025)	0.97	(0.012)	0.64	(0.030)
Model 4	0.61	(0.037)	0.73	(0.033)	0.60	(0.031)	0.80	(0.028)	0.90	(0.021)	0.66	(0.029)
Model 5	0.56*	(0.034)	0.75	(0.027)	0.60	(0.031)	0.70	(0.032)	1.01	(0.010)	1.00	(0.005)

Notes: Values in parentheses are standard errors.
* Indicates a failure to reject the null that $\alpha = 0.5$ at the 5% level.

The loss function is symmetric for $\alpha = 0.5$. $\alpha > 0.5$ ($\alpha < 0.5$) represents the case of forecasters having an incentive to issue overpredicted (underpredicted) forecasts.

The following orthogonality condition is shown by conditions for the optimality of forecasts:

$$E\left(\left[\alpha - I\left(y_{t+1} - f_{t+1} < 0\right)\right] \cdot \left|y_{t+1} - f_{t+1}\right|^{p-1} \cdot v_t\right) = 0, \tag{2}$$

where v_t denotes any subvector of instrumental variables from the information set Ω_t. Based on the moment condition, the parameter α can be estimated for a given parameter p by the generalized method of moments (GMM) estimation[12] (Hansen & West, 2002). The GMM estimation allows us to test the validity of the orthogonality condition (that is, the optimality (or rationality) of the forecast), using the J-test. The orthogonality condition for forecast rationality implies that the objective function of the GMM estimation should be zero at the optimum, and this is exactly what is tested by the J-test. Therefore, the shape of the loss function governed by the parameter α can be evaluated jointly with forecast rationality. The J-test is consistent even if the parameters of the loss function are estimated and the forecast depends on further unknown parameters. A J-statistic under the joint null hypothesis of rationality and a flexible loss function is distributed as a χ-squared distribution.

For instruments, I consider a constant[13] and the absolute lagged error (Model 1), the lagged actual and the lagged error (Model 2), the lagged change in actual (Model 3), and the lagged change in forecasts (Model 4). These sets of instruments have been used previously in the literature (e.g., Christodoulakis & Mamatzakis, 2009; Elliott et al., 2005). Furthermore, interest rate spreads[14] (Model 5), which are often good indicators of the business cycle, are also examined, in line with the work of Krüger and Hoss (2012). In particular, I consider Models 3 and 4 in order to avoid persistency of the instruments, since it could lead to limitations in the ability of the asymptotic theory to approximate the finite sample behavior of the tests (Elliott et al., 2008).

[12] Since the weighting matrix depends on the estimate of α, the estimation in this paper is iterative, assuming that the weighting matrix in the first round is an identity matrix. The continuously updated estimator of Hansen, Heaton, and Yaron (1996) and the Bartlett kernel are used for the sake of possible gains in finite sample efficiency.

[13] A constant is included as an instrument in all models considered in this paper. However, it is dropped hereafter for notational convenience.

[14] The interest rate spread is defined as the difference between the monthly average yields on 10-year government bonds and the monthly average of overnight call rates.

4. Results

4.1. Asymmetry parameter α

4.1.1. The government

Table 2 presents estimates for the asymmetry parameter[15] and its standard errors for the Japanese government. For F1, the null hypothesis of unbiased forecasts is rejected in Models 1 and 4 for real GDP growth, at the 5% significance level. In contrast, the null hypothesis in all models for nominal GDP growth is rejected at the 5% significance level, with all estimates being significantly larger than 0.5. The null hypothesis is rejected at the 5% significance level for inflation in all but Model 2. These results indicate that the government tends to produce overpredicted nominal GDP and inflation forecasts for F1, while the results for real GDP growth are mixed.

For F2, the government tends to produce overpredicted forecasts, irrespective of the target variables, as can be seen from the fact that the asymmetry parameter is significantly larger than 0.5 at the 5% level in all models. This is consistent with Ashiya's (2007) finding that the Japanese government's year-ahead real GDP growth forecast is too optimistic. Note that overprediction is more evident in the nominal GDP growth forecasts than in the real GDP growth forecasts. This suggests the over-accumulation of government debt in Japan, which is supported by Fig. 1. An overprediction of nominal GDP growth might cause an underprediction of government deficit, leading to an underprediction of government debt accumulation. Subsequently, the government could face and suffer from an unexpected and rapid accumulation of debt.

These overpredicted inflation forecasts are consistent with the view that governments can be tempted to "inflate away" some of their debt burden. For example, Aizenman and Marion (2011) showed that having a level of inflation that is slightly higher than that in the post-World War II period could reduce the US debt ratio significantly.

[15] Although results on the lin–lin case are not reported in this paper, they are available from the author upon request. They are generally consistent with the results reported. However, there are some cases in which the estimates of the asymmetry parameter are smaller than in the quad–quad case, particularly for F1. To conserve space, in general only the results regarding the Japanese government are reported, but all of the results are all available from the author upon request.

Table 3
Estimates of the asymmetry parameter α: IMF forecasts.

	F1						F2					
	Real GDP		Nominal GDP		Inflation		Real GDP		Nominal GDP		Inflation	
Model 1	0.35	(0.033)	0.47*	(0.028)	0.39	(0.039)	0.65	(0.045)	0.83	(0.031)	0.55*	(0.030)
Model 2	0.24	(0.025)	0.39	(0.029)	0.15	(0.026)	0.65	(0.050)	0.85	(0.025)	0.58	(0.029)
Model 3	0.21	(0.024)	0.50*	(0.029)	0.41	(0.031)	0.68	(0.049)	0.83	(0.036)	0.82	(0.034)
Model 4	0.34	(0.027)	0.40	(0.028)	0.44*	(0.033)	1.33	(0.107)	1.14	(0.039)	1.06	(0.054)
Model 5	0.44	(0.025)	0.49*	(0.029)	0.42	(0.031)	0.72	(0.060)	0.83	(0.043)	0.55*	(0.029)

Notes: Values in parentheses are standard errors.
* Indicates a failure to reject the null that $\alpha = 0.5$ at the 5% level.

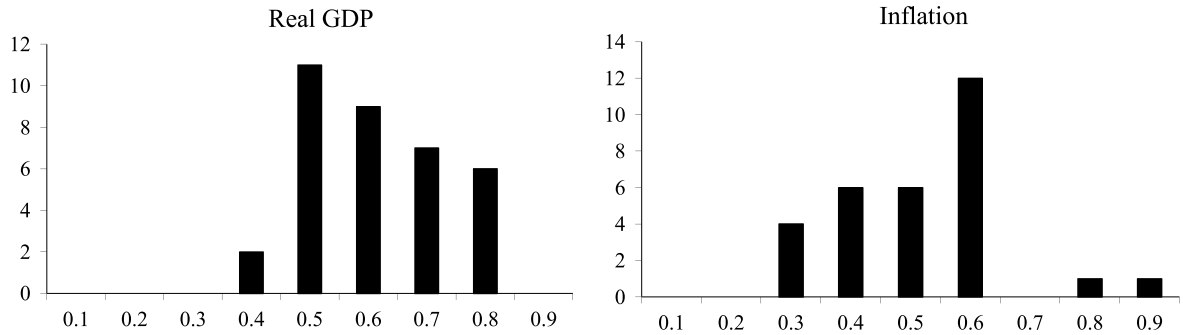

Fig. 2. Distribution of estimates of asymmetry parameter α: F1.

4.1.2. The IMF

Table 3 shows evidence that the IMF tends to produce underpredicted F1 values for real GDP growth and inflation, because all estimates except for that of Model 4 for inflation are highly significantly smaller than 0.5. The results for F1 for the nominal GDP growth are mixed; the estimates from three of the five models are not significantly different from 0.5. In contrast, the IMF is likely to produce overpredicted forecasts for F2. There are only two estimates for inflation that are not significantly different from 0.5.

Note that the F1 results differ markedly from those of the Japanese government, indicating that the IMF provides more prudent forecasts for F1. There are some instances in which the loss functions of the Japanese government and IMF differ between the forecast horizons F1 and F2. For example, the asymmetry in the real GDP growth forecasts from the IMF is underpredicted for F1 and overpredicted for F2. One possible reason for these differences may be the fact that the government and IMF have different policy stances and goals, depending on the horizon. Thus, bad outcomes could differ among those forecasters, and they may build these aversions into their forecasts for each horizon.

4.1.3. Consensus economics

Fig. 2 shows distributions of the estimates of the asymmetry parameter for F1. The total frequency for the real GDP growth is 35, since there are five models for each of the seven private forecasters. The total frequency for inflation is 30, since there are five models for each of the six private forecasters. The graph on the left broadly indicates unbiasedness and a slight asymmetry toward overprediction for real GDP growth, because many of the estimates lie above 0.6, whereas the remaining estimates indicate unbiased forecasts. The graph on the right indicates a lack of bias with regard to inflation, because most of the estimates lie between 0.4 and 0.6.

Fig. 3 shows the distributions of the estimates of the asymmetry parameter for F2. This figure indicates overpredicted F2 values for real GDP growth and inflation, since the majority of the estimates exceed 0.7.

Elliott et al. (2008) found considerable evidence of asymmetry in the loss functions of real GDP growth and inflation in the SPF; the majority of real growth forecasts were overpredicted, whereas the majority of inflation forecasts were underpredicted. In contrast, Döpke et al. (2010) focused on German data and found very limited evidence of asymmetry in the loss functions for real growth and inflation forecasts.

4.2. Rationality

4.2.1. Mincer–Zarnowitz rationality tests

To obtain an insight into the rationality of the forecasts, I consider rationality tests based on a version of the Mincer–Zarnowitz equation (Batchelor & Peel, 1998). A standard rationality test is conducted by estimating the following equation:

$$y_t = b_0 + b_1 f_t + u_t. \tag{3}$$

Under the assumption of a symmetric loss function, the rationality of the forecasts can be tested using a standard F-test. The null hypothesis is $b_0 = 0$ and $b_1 = 1$.

Table 4 shows the results of the Mincer–Zarnowitz rationality test for the Japanese government. The table indicates that, under a symmetric loss function, the F1 values for real and nominal GDP growth and for inflation

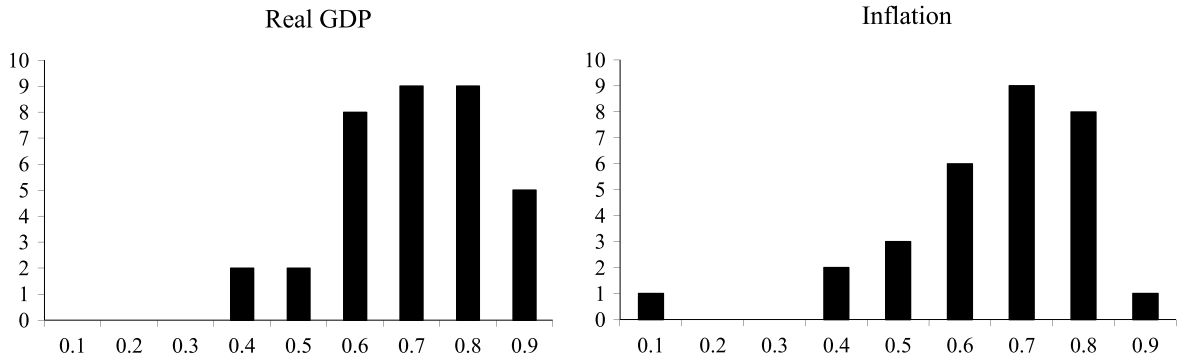

Fig. 3. Distribution of estimates of asymmetry parameter α: F2.

Table 4
Mincer–Zarnowitz rationality tests under a symmetric loss function: Government forecasts.

	b_0	b_1	F-statistics
Real GDP			
F1	−0.134 (0.182)	1.034 (0.051)	0.28 (0.754)
F2	−0.032 (0.757)	0.790 (0.168)	3.42 (0.043)
Nominal GDP			
F1	−0.304 (0.210)	1.009 (0.026)	1.61 (0.214)
F2	−0.947 (0.567)	0.882 (0.076)	9.50 (0.000)
Inflation			
F1	−0.089 (0.044)	1.026 (0.031)	2.08 (0.139)
F2	−0.215 (0.245)	0.812 (0.056)	4.90 (0.013)

Notes: Values in parentheses for b_0 and b_1 are Newey–West standard errors. The null hypotheses of the F-tests are $b_0 = 0$ and $b_1 = 1$, and p-values are in parentheses.

are rational, whereas the corresponding F2 values are not rational. The null hypothesis of rationality is rejected for F2, at the 5% significance level at least. This finding indicates that, while a short-term forecast is rational, a long-term forecast is not. This result is consistent with the findings of Ashiya (2007), who found evidence that the short-term real GDP growth forecast of the Japanese government is rational, unlike its year-ahead forecast. Döpke et al. (2010) concluded that the German government's year-ahead real GDP growth forecasts are rational, whereas its inflation forecasts are not.

Note that the constants in the nominal GDP growth forecasts are larger than those in the real GDP growth forecasts. This implies a larger negative bias—namely, overprediction in nominal GDP growth, which supports the findings in Fig. 1.

Although they are not reported here, I did make some observations vis-à-vis the results of the IMF and private forecasters. The majority of the IMF forecasts are not rational under a symmetric loss function. There is less evidence of the rejection of rationality for individual private forecasts.

4.2.2. *J*-test of rationality

I now examine the rationality of the forecasts made by the Japanese government, the IMF, and private forecasters under an asymmetric loss function.

Table 5 shows that all of the Japanese government forecasts are rational under asymmetric loss functions, because the null hypotheses of rationality are not rejected even at the 10% significance level. Although the results are not reported here, the IMF and individual private forecasts are also rational under asymmetric loss functions. Therefore, the forecasts from the Japanese government, the IMF, and private forecasters are all rational irrespective of the target variables and forecast horizons, which is broadly consistent with the results in the literature using an asymmetric loss function. Although the standard errors of the estimates are typically small, any failures of rationality could be due to the low power of the J-test, as a result of the small sample size. As large inefficiencies may not be detectable under asymmetric loss (Elliott et al., 2008) and the problem becomes greater when the asymmetry parameter is further away than one-half (Elliott et al., 2005), as is the case here, these empirical results do not necessarily provide strong evidence of forecast rationality.

However, this finding differs from those provided by the Mincer–Zarnowitz rationality tests, particularly with regard to the government's F2 values. This suggests that governments might be subject to political pressures, which will be reflected in their loss functions, and that the IMF is also likely to have asymmetric loss functions. Indeed, a review of previous studies does show collective evidence that various forecasters, including central banks, intergovernmental organizations, and private forecasters, have asymmetric loss functions. Thus, my investigation provides evidence to support these studies.

4.3. Information efficiency of the government's forecasts

I next examine whether the Japanese government uses the information provided in the IMF and consensus fore-

Table 5
J-test of rationality: Government forecasts.

	F1			F2		
	Real GDP	Nominal GDP	Inflation	Real GDP	Nominal GDP	Inflation
Model 1	1.190 (0.275)	1.332 (0.248)	1.021 (0.312)	1.093 (0.295)	1.011 (0.314)	1.384 (0.239)
Model 2	1.429 (0.489)	1.409 (0.494)	1.183 (0.553)	1.392 (0.498)	1.513 (0.469)	1.244 (0.536)
Model 3	0.167 (0.682)	0.756 (0.384)	0.929 (0.335)	1.322 (0.250)	1.184 (0.276)	1.241 (0.265)
Model 4	1.034 (0.309)	0.547 (0.459)	0.950 (0.329)	1.237 (0.266)	0.552 (0.457)	1.209 (0.271)
Model 5	1.116 (0.290)	0.961 (0.326)	0.299 (0.584)	0.002 (0.962)	1.287 (0.260)	0.997 (0.318)

Note: *p*-values are shown in parentheses.

Table 6
J-test of rationality of government forecasts: IMF forecasts incorporated.

	F1			F2		
	Real GDP	Nominal GDP	Inflation	Real GDP	Nominal GDP	Inflation
Model 1	1.256 (0.533)	1.204 (0.547)	1.346 (0.510)	1.257 (0.533)	1.062 (0.587)	1.108 (0.574)
Model 2	1.309 (0.727)	1.221 (0.747)	1.406 (0.704)	1.315 (0.725)	1.378 (0.710)	1.442 (0.695)
Model 3	1.378 (0.501)	1.190 (0.551)	1.322 (0.516)	1.280 (0.527)	1.235 (0.539)	1.223 (0.542)
Model 4	1.321 (0.516)	1.181 (0.553)	1.325 (0.515)	1.353 (0.508)	1.122 (0.570)	1.161 (0.559)
Model 5	1.368 (0.504)	1.332 (0.513)	1.272 (0.529)	1.210 (0.546)	0.916 (0.632)	1.229 (0.540)

Note: *p*-values are shown in parentheses.

Table 7
J-test of the rationality of government forecasts: Consensus forecasts incorporated.

	F1		F2	
	Real GDP	Inflation	Real GDP	Inflation
Model 1	1.045 (0.592)	1.280 (0.527)	1.165 (0.558)	1.173 (0.556)
Model 2	1.088 (0.779)	1.273 (0.735)	1.182 (0.757)	1.123 (0.771)
Model 3	0.812 (0.666)	1.277 (0.528)	1.332 (0.513)	1.241 (0.537)
Model 4	1.040 (0.594)	1.277 (0.528)	1.291 (0.524)	1.204 (0.547)
Model 5	1.146 (0.563)	1.278 (0.527)	1.286 (0.525)	0.750 (0.687)

Note: *p*-values are shown in parentheses.

casts efficiently when making its own forecasts. The forecasts produced by the IMF and private forecasters for the coming fiscal year, namely the F2 values, are released in September, and the Japanese government can take advantage of the information in these forecasts when making its own forecasts. Therefore, to investigate whether the Japanese government incorporates this information into its forecasts efficiently, Models 1–5, including the F2 values of the IMF and consensus forecasts, are estimated and *J*-tests are conducted.

Before investigating information efficiency, I would like to make a few observations regarding the asymmetry parameters that incorporate the above-mentioned forecasts from the IMF and the consensus as instruments, although I do not report on them here. Some of the asymmetry parameters are smaller than the main results, indicating less evidence of overprediction—in particular, asymmetry in F1 for real and nominal GDP growth (incorporating the IMF forecasts as an instrument), and for inflation (incorporating the consensus forecasts as an instrument).

Finally, I examine the information efficiency of the Japanese government using *J*-tests. *J*-tests of rationality that incorporate the IMF and consensus forecasts examine whether the information in these forecasts is used efficiently by the Japanese government. The information efficiencies of other forecasters' forecasts have been examined using regression analysis. However, considerations of a general loss function and the actual release date of the forecasts in information sets are rare.

Tables 6 and 7 show that none of the null hypotheses of information efficiency are rejected, even at the 10% significance level. Thus, these results indicate that, irrespective of the target variables and forecast horizons, the Japanese government uses the information provided by the IMF and consensus forecasts efficiently when making its own forecasts. Note again, though, that these results could result from the low power of the *J*-test.

5. Implications

I derive two implications for Japan's budget deficit and public debt from the findings revealed by the asymmetry parameter and information efficiency.

First, biases in Japanese economic forecasts may have played a crucial role in the rapid accumulation of debt outstanding, because the results of the asymmetry parameter show that, although the biases in F1 vary across sample periods, the biases in F2 are overpredicted regardless of the period. As Fig. 1 suggested, optimistic output forecasts are likely to result in unexpected budget deficits and the accumulation of debt. Furthermore, the results for Japanese forecasters contrast quite sharply with those obtained for German forecasters by Döpke et al. (2010), who concluded that (1) the German government's real GDP growth and inflation forecasts, for both the current year and the year ahead, are unbiased; (2) the IMF's real GDP growth and inflation forecasts for the

German economy are broadly unbiased, although there is slight evidence of optimism in the forecast for real GDP growth; and (3) German professional forecasters broadly provide unbiased forecasts for real GDP growth and inflation. Note that they did not examine the nominal GDP growth. The most vital result concerns the unbiasedness of even year-ahead forecasts. Thus, this difference between Japan and Germany might be crucial for their respective governments' budget forecasts.

In fact, Abeysinghe and Jayawickrama (2008) showed that conservative growth forecasts must have contributed to about 13% of the realized budget surplus per year in Singapore. Marinheiro (2011) also showed that, for the EU-15 economies, a 1% error in the government's growth forecasts could lead to a deviation of the budget balance from the planned level of at least 0.5% of the GDP. He also argued that correct forecasts of the GDP would be quite important in bringing down debt levels.

Furthermore, discussions on the findings of the IMF's budget deficit forecasts and their relationship with the economic forecasts of Japan and Germany support the above logic and lead to the second implication. Elliott et al. (2005) showed that the current-year IMF budget deficit forecasts for all G7 economies, except for Canada and France, are overpredicted, which points to prudent budget deficit forecasting. Similar results hold for the year-ahead forecasts. For the German budget deficits, the current year and year-ahead forecasts are both unbiased, which is consistent with actual economic outcomes. For Japan, the current year forecast is overpredicted, which implies a prudent deficit forecast. This is consistent with the results of its macroeconomic forecasts, as found in this paper. Its year-ahead forecast also leans toward overprediction—that is, it is prudent. However, this overprediction is somewhat weaker than that of the current year. Because the budget deficit is measured as the ratio to the nominal GDP, the divergence in the biases of economic and budget deficit forecasts by the IMF implies that its nominal GDP forecast is relatively underpredicted compared to its actual budget deficit forecast. In other words, the tax revenue forecast is even more conservative than the nominal GDP forecasts, assuming that tax outlays are not impacted by them. As has been mentioned, the nominal GDP is a first approximation of a country's income; thus, it can serve as a rough indicator of tax revenues. An overprediction of the nominal GDP growth might cause an underprediction of the government deficit, given that a deficit forecast is unbiased. Thus, it may be sensible for the Japanese government to capitalize on the prudent budget forecasts of the IMF.

Second, as was suggested by Frankel (2011), another important policy implication is the need to establish an independent organization to be responsible for such projections. Although the Japanese government uses the information from the forecasts of the IMF and private forecasters efficiently, the biases in F2 are overpredicted. This suggests that the Japanese government might be even more optimistic if the forecasts of the IMF and private forecasters were not provided. The IMF and consensus forecasts are widely considered as benchmarks, and it would be difficult for the Japanese government to deviate from those forecasts without a reasonably credible rationale for doing so. Thus, there is no room for it to improve its forecasts unless the forecasts are prepared by an organization that is exempt from political pressure. Note, however, that this is only one possibility, and further investigation of this type extends beyond the scope of this paper. For example, Chile's official forecasts of growth and the budget have avoided over-optimism ever since structural budget institutions were created. Independent expert panels, which are insulated from political pressures, are responsible for these forecasts. Unlike many countries in the North, Chile profited from the 2002–2007 expansion by running budget surpluses. Information from many other countries and the findings of the asymmetry parameter in this paper indicate that the Japanese government's forecasts are likely to be subject to politico-institutional influences. For instance, Maekawa and Fukushige (2012) noted that Japan's growth estimate is too optimistic, and that the government tries to underestimate its tax revenue projections and economic forecasts. However, owing to other factors,[16] its actual projections or economic forecasts were often not underestimated.

6. Conclusion

This paper has examined the asymmetry of the loss functions of the Japanese government, the IMF, and private forecasters for Japanese output growth and inflation forecasts. It has also tested the rationality of the forecasts under the assumption of a possibly asymmetric loss function.

The paper has found considerable evidence of asymmetry. The 15-month forecasts are overpredicted, irrespective of the forecasting identities and target variables. However, the biases in the three-month forecasts vary among the forecasters. The IMF provides prudent short-term forecasts for output growth and inflation, and private forecasters provide unbiased inflation forecasts. The Japanese government uses the information provided by the IMF and private forecaster forecasts efficiently when making its own forecasts.

I also arrive at two important implications by comparing this paper's findings with those in the literature on German forecasts. First, biases in economic forecasts may have played a crucial role in Japan's rapid and high accumulation of debt. Second, these biases could be due to the effects of complicated politico-institutional processes on the economic and budget forecasts within government agencies. Thus, it may be worthwhile to establish an independent organization that is free from external influences for making such projections.

A further investigation of the relationship between economic and budget forecasts would be interesting. To do so, and to obtain additional useful information, it would be necessary to focus on the nominal GDP.

16 One of the factors that may be complicating these projections is the politico-institutional factor. Two government agencies, the Ministry of Finance and the Cabinet Office, are responsible for these projections.

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Appendix

Seven individual forecasters were considered for the real GDP growth projections: Daiwa Institute of Research, Japan Center for Economic Research, JP Morgan, Merrill Lynch, Nomura Securities, Toyota Motor Corporation, and UBS. Projections for CPI were made by six individual forecasters: Japan Center for Economic Research, JP Morgan, Merrill Lynch, Nomura Securities, Toyota Motor Corporation, and UBS.

The Japan Center for Economic Research and Toyota Motor Corporation participated in the survey throughout the entire sample period. The other forecasters experienced either a merger/acquisition (e.g., S.G. Warburg & Co. was acquired by UBS) or transfers of participation among company groups (e.g., participation in the survey was transferred from Nomura Securities to Nomura Research Institute, owing to a reallocation). I considered such forecasters as one continuous forecast series, in order to ensure a sufficient number of individual forecasters for this study.

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