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Testing the Rationality of Forecast Revisions Made by the IMF and the OECD

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We investigate the rationality of forecast revisions made by the IMF and the OECD over the past three decades. We find that 60% of real-GDP forecast series and 37% of GDP-deflator forecast series are consistent with rationality. Forecast smoothing is found in real-GDP forecasts.

JEL Classification Codes: E37; C53; E17.

Keywords: Rational expectations hypothesis; Forecast evaluation; Forecast revision; Forecast smoothing.

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1. Introduction

Over the past decades, there are a plenty of studies on the rationality of economic forecasts. Some of them examine forecast revisions. Typically, economic forecasters closely watch economic conditions, and revise their forecasts periodically. Recent research has shown that these forecast revisions are subject to behavioral biases. Some researchers have shown that economic forecasters over-react to new information (Clements, 1995, 1997; Ehrbeck and Waldmann, 1996; Ashiya, 2002, 2003), while others have found that security analysts under-react to new information (Abarbanell and Bernard, 1992; Amir and Ganzach, 1998). Still others have found that forecasters utilize new information too slowly (Berger and Krane, 1985; Nordhaus, 1987; Scotese, 1994; Loungani, 2001; Harvey et al., 2001).

This paper employs their methodology and investigates the rationality of forecast revisions made by the International Monetary Fund (IMF) and the Organization for Economic Cooperation and Development (OECD). Using these organizations' forecast data from the past three decades, it examines how they incorporate new information into revised forecasts of real GDP and GDP deflator for the G7 countries. It finds that 60% of real-GDP forecast series and 37% of GDP-deflator forecast series are consistent with rationality. Moreover, it finds that real-GDP forecasts are excessively smooth, indicating that forecasters utilize new information too slowly. All these findings are common to both IMF and OECD forecasts.

The rationality of IMF and OECD forecasts has been evaluated by a considerable numbers of studies (Holden et al., 1987; Ash et al., 1990, 1998; Artis, 1996; Pons, 1999, 2000, 2001; Kreinin, 2000; Öller and Barot, 2000; Batchelor, 2001; Elliott et al., forthcoming). These studies have shown that IMF and OECD forecasts pass most conventional tests for rationality. However, none has examined the rationality of their *forecast revisions*. This paper is the first attempt to fill this gap.

The paper is organized as follows. Section 2 explains the data, and Section 3 explains the methodology. Section 4 reports the results, and Section 5 concludes the paper.

2. Data

2.1 IMF

The IMF has published real-GDP and GDP-deflator forecasts for the G7 countries in the

May and the October issues of "World Economic Outlook" since 1984. The May issue in year t contains the eight-month forecast for year t ($f_{-8,t}$) and the 20-month forecast for year $t+1$ ($f_{-20,t+1}$). The October issue in year t contains the two-month forecast for year t ($f_{-2,t}$) and the 14-month forecast for year $t+1$ ($f_{-14,t+1}$). Additional information is obtained from Artis and Zhang (1990) and Artis (1996), which contain the data for $f_{-20,t+1}$ from $t=1980$ and $f_{-8,t}$ and $f_{-14,t+1}$ from $t=1972$. However, we discard $f_{-20,t+1}$ from $t=1980$ to $t=1987$ for both GDP and inflation forecasts because $f_{-20,t+1}=f_{-14,t+1}$ for all countries in this period. We use the data through $t=2003$.

As for the realization g_t, Keane and Runkle (1990) argue that the revised data introduces a systematic bias because the extent of revision is unpredictable for the forecasters (see also Stark and Croushore, 2002). For this reason we use the initial announcements of the real-GDP growth rate and the inflation rate (measured by the GDP deflator) published in the May issue of "World Economic Outlook".

2.2 OECD

The OECD has published real-GDP and GDP-deflator forecasts for the G7 countries in the June and December issues of "OECD Economic Outlook" since 1967. The June issue in year t contains the seven-month forecast for year t ($f_{-7,t}$) since 1967, and the 19-month forecast for year $t+1$ ($f_{-19,t+1}$) since 1981. The December issue in year t reports the one-month forecast for year t ($f_{-1,t}$) since 1967, the 13-month forecast for year $t+1$ ($f_{-13,t+1}$) since 1967, and the 25-month forecast for year $t+2$ ($f_{-25,t+2}$) since 1987.[1] We use the data through $t=2003$. As for the realization g_t, we use the initial announcement published in the June issue of "OECD Economic Outlook".

3. Methodology

This section illustrates our methods for evaluating forecast rationality. The basic idea is that a rational forecaster should use available information efficiently. Thus, forecast error should not be related to information available when the forecast was made, and a forecast revision should not be related to information available when the earlier forecast

was made.

Let us take the IMF forecasts as an example. The IMF releases four forecasts for a given year t: $f_{-20,t}$, $f_{-14,t}$, $f_{-8,t}$, and $f_{-2,t}$. Remember that $f_{-i,t}$ is the forecast for year t released i months prior to the end of year t. Define $FE_{-i,t} \equiv f_{-i,t} - g_t$ as the forecast error of $f_{-i,t}$ and $FR_{-i,t} \equiv f_{-i,t} - f_{-i-6,t}$ as the forecast revision that was made i months prior to the end of year t.

First, we examine the rationality of forecast revisions ($FR_{-i,t}$). Berger and Krane (1985, p.130) argue that " if forecasts are formed in a consistent fashion, then current forecast revisions should not be at all predictable from past revisions". The regressions they consider are

$$FR_{-i,t} = \alpha + \beta \cdot FR_{-i,t-1} + u_{-i,t} \qquad (1)$$

and $$FR_{-i,t} = \alpha + \beta \cdot FR_{-i-6,t} + u_{-i,t}. \qquad (2)$$

The null hypothesis of rationality is $\beta = 0$.[2] We allow a nonzero intercept because average forecast revision could be positive (negative) when the economy continually experiences positive (negative) shocks. Equation (1) evaluates the serial correlation of forecast revisions for a fixed *forecast horizon*. Rejection of the null hypothesis indicates that the forecaster fails to utilize the information previously used to revise the forecast for the same *horizon*. On the other hand, equation (2) evaluates the serial correlation of forecast revisions for a fixed *future realization*. Rejection of the null indicates that the forecaster fails to utilize the information previously used to revise the forecast for the same *realization*.[3]

Next, we examine the rationality of forecast errors ($FE_{-i,t}$). If a forecast is rational, its forecast error should be independent of its past forecast revisions. Nordhaus (1987), Ehrbeck and Waldmann (1996), and Amir and Ganzach (1998) consider the following regression:

$$FE_{-i,t} = \alpha + \beta \cdot FR_{-i,t} + u_{-i,t}. \qquad (3)$$

The null hypothesis is $\alpha = \beta = 0$. $\alpha \neq 0$ indicates the forecast is biased. $\beta \neq 0$ indicates the forecast could be improved by the information on forecast revisions.

Ashiya (2003) further develops this idea and points out two factors that influence forecast accuracy: optimism/pessimism and over-/under-reaction. If forecasters are optimistic (pessimistic), their forecast errors tend to be positive (negative). If forecasters

over-react to new information, their forecast errors tend to be positive (negative) when they obtain good (bad) news, i.e., when their forecast revisions are positive (negative). Similarly, if forecasters under-react to new information, their forecast errors tend to be negative (positive) when their forecast revisions are positive (negative).

Since the sign of a forecast error is affected by the combination of these two factors, the sign of a forecast revision is crucial for the analysis. For example, a positive forecast error does not necessarily indicate optimism, because pessimism plus over-reaction (under-reaction) may result in a positive forecast error when the forecast revision is positive (negative). On this ground, Ashiya (2003) argues that the data should be divided into two sub-samples according to the sign of forecast revisions in order to extract useful information from equation (3). This paper follows his methodology, and estimates

$$FE_{-i,t} = \alpha + \beta \cdot FR_{-i,t} + u_{-i,t} \quad \text{s.t.} \quad t \in T^{+} \equiv \left\{ t \middle| FR_{-i,t} > 0 \right\} \qquad (4)$$

and $$FE_{-i,t} = \alpha + \beta \cdot FR_{-i,t} + u_{-i,t} \quad \text{s.t.} \quad t \in T^{-} \equiv \left\{ t \middle| FR_{-i,t} < 0 \right\} \qquad (5)$$

in addition to equation (3). The null hypothesis is $\alpha = \beta = 0$. Positive α implies optimism, while negative α implies pessimism. Positive (negative) β implies over-reaction (under-reaction) to new information.

4. Results

This section presents the estimation results of equations (1) through (5) for the real-GDP forecasts and GDP-deflator forecasts made by the IMF and the OECD. Subsection 4.1 shows the results of the IMF forecasts, and Subsection 4.2 shows those of the OECD forecasts. Subsection 4.3 discusses the results. See Table 5 for the summary.

4.1 IMF forecast

We consider the rationality of forecast revisions for $f_{-2,t}$ (two-month forecast) and $f_{-8,t}$ (eight-month forecast). Table 1 shows the results for the real-GDP forecasts, and Table 2 shows the results for the GDP-deflator forecasts. Figures in parentheses are standard errors.

Table 1(a) indicates that the null of rationality is not rejected at the 0.05 significance level in any equation for Germany, Italy, and the UK. Namely, the real-GDP forecast series of $f_{-2,t}$ for Germany, Italy, and the UK pass all rationality

tests. On the other hand, the null is rejected in equation (2) for France and Japan, equation (3) for Canada, and equation (4) for Japan and the USA. Therefore, the forecast series for these countries fail the rationality test. Similarly, Table 1(b) indicates that the real-GDP forecast series of $f_{-8,t}$ for France,[4] Germany, the UK, and the USA pass all rationality tests, but those for Canada (equation (2)), Italy (equations (2), (3), and (5)) and Japan (equations (3), (4), and (5)) fail the test.

As for the GDP-deflator forecasts, Table 2(a) shows that $f_{-2,t}$ for Canada, Italy, and the UK pass the test, while those for France (equation (5)), Germany (equation (3)), Japan (equations (3) and (4)), and the USA (equation (3)) fail. Table 2(b) shows that $f_{-8,t}$ for Germany, Italy, and the UK pass the test, but those for Canada (equation (5)), France (equations (3) and (5)), Japan (equation (5)), and the USA (equations (3) and (5)) fail.

4.2 OECD forecast

We consider the rationality of forecast revisions for $f_{-1,t}$, $f_{-7,t}$, and $f_{-13,t}$. Table 3(a) indicates that the real-GDP forecast series of $f_{-1,t}$ for Germany, Italy, and the USA pass all rationality tests at the 0.05 significance level. However, those for Canada (equation (2)), France (equation (4)), Japan (equation (4)), and the UK (equation (3)) fail the test. Table 3(b) shows that $f_{-7,t}$ for France, Germany, the UK, and the USA pass the test, while those for Canada (equation (3)), Italy (equation (2)), and Japan (equation (4)) fail. Table 3(c) indicates that real-GDP forecast series of $f_{-13,t}$ passes the rationality test for all countries.

Table 4 demonstrates that only seven series of GDP-deflator forecast pass the test: they are $f_{-1,t}$ for Germany and Italy (Table 4(a)), $f_{-7,t}$ for Germany and the UK (Table 4(b)), and $f_{-13,t}$ for Germany, Italy, and the UK (Table 4(c)).

4.3 Discussion

This subsection addresses the following three issues. For which countries do the IMF and the OECD release rational forecasts? Are GDP forecasts more consistent with rationality than inflation forecasts? What implication can be drawn from the estimation results of equations (1) through (5)?

Table 5 reports the forecast series for which the null of rationality is not rejected in any equation at the 0.05 significance level. The third and the sixth row show that all series of OECD forecasts for Germany and all series of IMF forecasts for the UK pass the rationality test. By contrast, the fifth row shows that no series of IMF forecast for Japan pass the test. Overall, forecasts for Germany, the UK, and Italy fare well in the rationality test, while forecasts for Japan, Canada, and France do not.

The last row of Table 5 indicates the number of G7 countries for which the null of rationality is not rejected in any equation of the corresponding forecast series at the 0.05 significance level. The first column shows that three out of seven series of two-month GDP forecast made by the IMF pass the rationality test, and so on. Table 5 shows that 21 out of 35 real-GDP forecast series pass the rationality test, but only 13 out of 35 GDP-deflator forecast series pass the rationality test. These results are consistent with Zarnowitz (1985) and Batchelor and Dua (1991), which find a relatively poor performance in inflation forecast.

As for the individual equations, the estimation results of equation (2) for real-GDP forecast series are striking. Tables 1 and 3 show that β is positive in equation (2) for 32 out of 35 real-GDP forecast series. Calculation of the cumulative binomial distribution shows that the *P*-value of the sign test is 2.1×10^{-7}. Since $\beta > 0$ indicates that a forecast revision in one direction tends to be followed by further revisions in the same direction, this result demonstrates a strong tendency for forecast smoothing in the real-GDP forecast. Our result is consistent with that of Berger and Krane (1985), Nordhaus (1987), and Loungani (2001), although Clements (1997) finds a negative correlation among forecast revisions.[5]

5. Conclusions

This paper has analyzed the rationality of forecast revisions made by the IMF and the OECD over the past three decades. It has considered five regressions for the rationality test, and has employed them for real-GDP and GDP-deflator forecast series of various forecast horizons. It finds that 60% of real-GDP forecast series and 37% of GDP-deflator forecast series are consistent with rationality. It also finds evidence of slow adjustment to new information in real-GDP forecasts. These results shed new light on the rationality of forecast revisions, and would be helpful in interpreting revised forecasts.

Notes

1. $f_{-13,1972}$ for the GDP forecasts are missing, and we adopt the figures in the Appendix of Pons (1999). As for the forecasts of GDP deflator, $f_{-13,1971}$ and $f_{-13,1972}$ for all countries, $f_{-7,1973}$ for USA, and $f_{-13,1973}$ for UK are missing.
2. When the residual distribution is fat-tailed, we also estimate the modified regression in which the square root of the dependent variable is regressed on the square root of the independent variable. Then the residual distribution becomes thin-tailed, but the estimation result remains unchanged.
3. Nordhaus (1987), Clements (1995), and Loungani (2001) also consider equation (2).
4. We allow a nonzero intercept for equations (1) and (2).
5. Interestingly, we do not find a tendency for forecast smoothing in inflation forecast: β is positive in equation (2) for 16 out of 35 inflation forecast series.

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Table 1: real GDP forecast of IMF

(a) $f_{-2,t}$

		(1)	(2)	(3)	(4)	(5)
Canada	α	0.072 (0.192)	0.061 (0.195)	0.007 (0.077)	0.194 (0.245)	0.179 (0.180)
	β	-0.053 (0.234)	0.046 (0.215)	-0.208 (0.094)*	-0.493 (0.282)	0.046 (0.220)
	n	20	21	20	9	10
France	α	-0.033 (0.129)	0.156 (0.132)	-0.065 (0.074)	0.160 (0.242)	-0.021 (0.225)
	β	-0.282 (0.229)	0.376 (0.161)*	-0.180 (0.130)	-0.600 (0.351)	0.039 (0.410)
	n	20	21	20	7	10
Germany	α	0.044 (0.160)	0.123 (0.165)	0.048 (0.124)	0.215 (0.379)	-0.189 (0.219)
	β	0.178 (0.234)	0.145 (0.138)	-0.215 (0.180)	-0.370 (0.452)	-0.560 (0.394)
	n	20	21	20	9	10
Italy	α	-0.163 (0.106)	-0.072 (0.120)	0.035 (0.107)	-0.457 (0.776)	0.245 (0.171)
	β	-0.145 (0.221)	0.101 (0.166)	-0.443 (0.223)	0.286 (1.721)	-0.012 (0.322)
	n	20	21	20	6	12
Japan	α	0.150 (0.271)	0.480 (0.261)	-0.133 (0.106)	-0.510 (0.224)*	0.179 (0.269)
	β	-0.067 (0.234)	0.552 (0.234)*	-0.045 (0.092)	0.303 (0.214)	0.093 (0.201)
	n	20	21	20	13	7
UK	α	0.044 (0.101)	0.020 (0.100)	-0.008 (0.107)	0.135 (0.376)	-0.200 (0.514)
	β	-0.114 (0.233)	-0.035 (0.092)	-0.479 (0.245)	-0.773 (0.736)	-0.813 (1.212)
	n	20	21	20	9	8
USA	α	0.102 (0.123)	0.180 (0.148)	0.006 (0.092)	-0.474 (0.107)**	-0.087 (0.244)
	β	-0.130 (0.170)	0.246 (0.159)	-0.006 (0.127)	0.472 (0.113)**	-0.639 (0.618)
	n	20	21	20	10	10

(b) $f_{-8,t}$

		(1)	(2)	(3)	(4)	(5)
Canada	α	-0.519 (0.210)*	-0.234 (0.190)	0.107 (0.240)	-0.344 (0.538)	0.337 (0.507)
	β	-0.169 (0.176)	0.759 (0.346)*	-0.161 (0.201)	0.230 (0.669)	-0.027 (0.356)
	n	31	17	31	12	18
France	α	-0.487 (0.183)*	-0.423 (0.207)	0.078 (0.197)	-0.107 (0.243)	-0.200 (0.446)
	β	-0.157 (0.183)	0.219 (0.443)	-0.234 (0.197)	0.232 (0.328)	-0.489 (0.384)
	n	31	17	31	10	19
Germany	α	-0.582 (0.247)*	-0.500 (0.293)	0.308 (0.242)	-0.114 (0.457)	0.408 (0.494)
	β	-0.119 (0.182)	0.837 (0.682)	-0.023 (0.178)	0.374 (0.379)	-0.019 (0.332)
	n	31	17	31	9	20
Italy	α	-0.374 (0.210)	-0.201 (0.171)	-0.012 (0.208)	0.102 (0.581)	-0.096 (0.303)
	β	0.082 (0.185)	1.130 (0.453)*	-0.394 (0.183)*	-0.391 (0.812)	-0.464 (0.216)*
	n	31	17	31	13	17
Japan	α	-0.747 (0.307)*	-0.434 (0.269)	-0.267 (0.236)	-1.249 (0.415)*	-0.745 (0.315)*
	β	-0.091 (0.187)	0.591 (0.355)	-0.459 (0.144)**	1.410 (0.479)*	-0.701 (0.168)**
	n	31	17	31	8	22
UK	α	-0.449 (0.260)	-0.421 (0.269)	0.067 (0.188)	-0.311 (0.490)	0.182 (0.377)
	β	0.098 (0.182)	0.685 (0.581)	0.078 (0.132)	0.554 (0.624)	0.117 (0.214)
	n	31	17	31	12	18
USA	α	-0.127 (0.240)	0.123 (0.254)	-0.052 (0.171)	-0.419 (0.338)	0.060 (0.412)
	β	-0.090 (0.185)	0.311 (0.677)	-0.085 (0.132)	0.160 (0.256)	-0.063 (0.314)
	n	31	17	31	14	16

Notes
Standard errors are in parentheses.
*/**: Significant at the 0.05/0.01 level respectively.

Table 2: inflation forecast of IMF

(a) $f_{-2,t}$

		(1)	(2)	(3)	(4)	(5)
Canada	α	0.122 (0.193)	0.050 (0.217)	0.254 (0.123)	0.708 (0.733)	0.208 (0.347)
	β	0.326 (0.236)	-0.072 (0.285)	-0.136 (0.151)	-0.650 (0.840)	-0.173 (0.449)
	n	20	21	20	9	11
France	α	0.039 (0.096)	0.039 (0.090)	0.097 (0.077)	0.022 (0.183)	0.258 (0.081)*
	β	0.138 (0.236)	-0.235 (0.191)	0.073 (0.188)	-0.005 (0.430)	0.586 (0.175)*
	n	20	21	20	10	7
Germany	α	-0.083 (0.064)	-0.095 (0.066)	0.043 (0.090)	-0.052 (0.313)	0.048 (0.179)
	β	-0.170 (0.207)	-0.003 (0.132)	-0.686 (0.292)*	0.217 (1.135)	-0.825 (0.457)
	n	20	21	20	5	10
Italy	α	0.134 (0.094)	0.083 (0.093)	-0.185 (0.145)	-0.094 (0.425)	0.348 (0.615)
	β	-0.292 (0.223)	0.037 (0.094)	0.402 (0.344)	0.241 (1.014)	1.105 (1.078)
	n	20	21	20	11	5
Japan	α	-0.154 (0.115)	-0.117 (0.115)	0.240 (0.093)*	0.600 (0.207)*	0.432 (0.262)
	β	-0.070 (0.234)	0.070 (0.194)	0.221 (0.190)	-0.750 (0.470)	0.616 (0.487)
	n	20	21	20	7	12
UK	α	-0.126 (0.150)	-0.145 (0.141)	-0.171 (0.136)	-0.845 (0.472)	0.069 (0.329)
	β	0.162 (0.233)	-0.032 (0.190)	0.262 (0.211)	1.398 (0.877)	0.490 (0.415)
	n	20	21	20	7	10
USA	α	0.014 (0.075)	-0.016 (0.095)	0.113 (0.048)*	0.159 (0.094)	0.437 (0.298)
	β	-0.114 (0.237)	-0.052 (0.154)	0.261 (0.151)	0.029 (0.314)	1.058 (0.723)
	n	20	21	20	9	7

(b) $f_{-8,t}$

		(1)	(2)	(3)	(4)	(5)
Canada	α	0.043 (0.184)	-0.290 (0.174)	-0.067 (0.245)	0.114 (0.703)	0.775 (0.321)*
	β	0.227 (0.181)	0.376 (0.533)	-0.330 (0.242)	-0.605 (0.555)	0.709 (0.376)
	n	31	17	31	13	15
France	α	-0.040 (0.192)	-0.007 (0.106)	-0.120 (0.158)	-0.095 (0.309)	0.271 (0.407)
	β	-0.066 (0.183)	-0.394 (0.310)	0.464 (0.151)**	0.291 (0.278)	0.895 (0.372)*
	n	31	17	31	14	14
Germany	α	0.004 (0.093)	0.014 (0.118)	0.191 (0.126)	-0.068 (0.291)	0.690 (0.336)
	β	0.211 (0.171)	0.799 (0.473)	0.300 (0.231)	0.469 (0.431)	1.430 (0.699)
	n	31	17	31	13	14
Italy	α	0.286 (0.305)	0.256 (0.149)	-0.440 (0.265)	-0.861 (0.600)	-0.353 (0.288)
	β	0.350 (0.174)	0.721 (0.427)	-0.054 (0.151)	0.192 (0.293)	-0.292 (0.203)
	n	31	17	31	17	12
Japan	α	-0.074 (0.305)	-0.108 (0.149)	0.437 (0.310)	0.099 (0.894)	0.041 (0.312)
	β	-0.244 (0.180)	0.379 (0.298)	-0.295 (0.183)	-0.085 (0.366)	-0.937 (0.282)**
	n	31	17	31	11	19
UK	α	0.420 (0.373)	0.114 (0.184)	-0.363 (0.270)	-0.405 (0.607)	-0.318 (0.569)
	β	0.050 (0.185)	-0.337 (0.359)	0.203 (0.134)	0.234 (0.216)	0.076 (0.548)
	n	31	17	31	14	14
USA	α	-0.124 (0.156)	-0.399 (0.132)**	-0.012 (0.096)	0.118 (0.578)	0.307 (0.126)*
	β	0.214 (0.181)	0.153 (0.401)	-0.279 (0.112)*	-0.458 (0.417)	0.292 (0.201)
	n	31	17	31	7	24

Notes
Standard errors are in parentheses.
*/**: Significant at the 0.05/0.01 level respectively.

Table 3: real GDP forecast of OECD

(a) $f_{-1,t}$

		(1)	(2)	(3)	(4)	(5)
Canada	α	-0.297 (0.138)*	-0.178 (0.115)	-0.092 (0.082)	-0.105 (0.154)	-0.038 (0.196)
	β	-0.284 (0.163)	0.410 (0.102)**	-0.023 (0.096)	-0.073 (0.233)	0.038 (0.200)
	n	37	37	37	13	22
France	α	-0.083 (0.122)	-0.090 (0.123)	-0.057 (0.064)	-0.273 (0.117)*	-0.093 (0.145)
	β	0.161 (0.166)	0.069 (0.119)	-0.019 (0.088)	0.272 (0.192)	-0.050 (0.158)
	n	37	37	37	15	17
Germany	α	0.012 (0.149)	0.046 (0.142)	-0.028 (0.061)	-0.265 (0.134)	0.013 (0.156)
	β	-0.001 (0.168)	0.221 (0.113)	-0.013 (0.069)	0.193 (0.152)	0.031 (0.153)
	n	37	37	37	17	15
Italy	α	-0.190 (0.158)	-0.145 (0.156)	-0.010 (0.098)	0.342 (0.254)	0.157 (0.210)
	β	-0.143 (0.168)	0.122 (0.125)	-0.016 (0.105)	-0.322 (0.221)	0.194 (0.232)
	n	37	37	37	11	22
Japan	α	0.099 (0.241)	0.136 (0.237)	-0.137 (0.133)	0.654 (0.252)*	-0.061 (0.318)
	β	-0.051 (0.166)	0.162 (0.127)	-0.039 (0.092)	-0.617 (0.174)**	0.177 (0.198)
	n	37	37	37	20	14
UK	α	-0.021 (0.135)	-0.055 (0.136)	-0.076 (0.077)	0.196 (0.237)	-0.107 (0.155)
	β	0.045 (0.168)	-0.120 (0.105)	0.253 (0.095)*	-0.134 (0.343)	0.261 (0.156)
	n	37	37	37	19	15
USA	α	-0.105 (0.099)	-0.109 (0.098)	-0.061 (0.056)	0.183 (0.211)	-0.119 (0.088)
	β	-0.023 (0.169)	0.044 (0.091)	-0.173 (0.096)	-0.672 (0.421)	-0.202 (0.127)
	n	37	37	37	16	18

(b) $f_{-7,t}$

		(1)	(2)	(3)	(4)	(5)
Canada	α	-0.149 (0.185)	0.056 (0.262)	0.123 (0.157)	-0.216 (0.332)	0.408 (0.367)
	β	-0.321 (0.162)	0.298 (0.341)	-0.283 (0.138)*	-0.058 (0.335)	-0.094 (0.282)
	n	36	23	36	15	19
France	α	-0.129 (0.171)	-0.099 (0.166)	0.057 (0.142)	-0.745 (0.456)	-0.021 (0.353)
	β	-0.241 (0.165)	0.386 (0.218)	-0.064 (0.137)	0.477 (0.289)	-0.251 (0.362)
	n	36	23	36	8	20
Germany	α	-0.197 (0.214)	-0.174 (0.230)	-0.043 (0.166)	0.579 (0.510)	0.064 (0.317)
	β	-0.038 (0.168)	0.126 (0.248)	-0.157 (0.130)	-0.832 (0.515)	-0.061 (0.206)
	n	36	23	36	16	18
Italy	α	-0.139 (0.212)	-0.067 (0.104)	0.165 (0.189)	-0.053 (0.410)	0.206 (0.242)
	β	0.200 (0.168)	0.287 (0.122)*	-0.131 (0.151)	0.325 (0.382)	-0.245 (0.159)
	n	36	23	36	15	17
Japan	α	-0.299 (0.317)	-0.166 (0.180)	-0.188 (0.291)	-0.855 (0.390)*	-0.299 (0.607)
	β	-0.225 (0.168)	0.260 (0.168)	0.030 (0.154)	0.799 (0.335)*	-0.083 (0.252)
	n	36	23	36	18	18
UK	α	-0.270 (0.225)	-0.040 (0.172)	-0.010 (0.129)	-0.331 (0.295)	0.015 (0.228)
	β	0.053 (0.172)	0.137 (0.256)	0.162 (0.099)	0.470 (0.332)	0.167 (0.146)
	n	36	23	36	13	21
USA	α	0.170 (0.186)	0.303 (0.212)	0.064 (0.131)	0.216 (0.306)	-0.459 (0.333)
	β	-0.111 (0.171)	0.075 (0.242)	-0.057 (0.120)	-0.103 (0.277)	-0.477 (0.273)
	n	36	23	36	19	13

Notes
Standard errors are in parentheses.
*/**: Significant at the 0.05/0.01 level respectively.

Table 3: real GDP forecast of OECD (continued)

(c) $f_{-13,t}$

		(1)	(2)	(3)	(4)	(5)
Canada	α	-0.417 (0.157)*	-0.457 (0.168)*	0.022 (0.495)	-3.544 (2.162)	-0.089 (0.847)
	β	-0.108 (0.204)	-0.171 (0.373)	-0.640 (0.639)	13.056 (8.003)	-0.761 (0.915)
	n	23	17	22	5	15
France	α	-0.358 (0.158)*	-0.305 (0.158)	0.121 (0.243)	0.452 (0.320)	-0.605 (0.758)
	β	0.011 (0.207)	0.462 (0.424)	-0.196 (0.321)	-0.565 (0.568)	-0.900 (0.829)
	n	23	17	22	8	12
Germany	α	-0.363 (0.202)	-0.272 (0.138)	0.208 (0.326)	0.827 (0.874)	0.737 (0.633)
	β	0.076 (0.217)	0.393 (0.258)	-0.014 (0.344)	-2.729 (1.990)	0.393 (0.529)
	n	23	17	22	6	13
Italy	α	-0.296 (0.183)	-0.422 (0.160)*	0.274 (0.204)	-0.110 (0.250)	0.667 (0.517)
	β	0.179 (0.214)	0.913 (0.575)	-0.470 (0.237)	0.281 (0.427)	-0.194 (0.501)
	n	23	17	22	7	13
Japan	α	-0.243 (0.233)	-0.412 (0.263)	-0.027 (0.362)	0.112 (1.079)	0.484 (0.725)
	β	0.104 (0.218)	0.339 (0.396)	-0.465 (0.333)	-0.880 (1.161)	-0.018 (0.622)
	n	23	17	22	8	14
UK	α	-0.142 (0.145)	-0.247 (0.164)	-0.036 (0.270)	0.406 (1.058)	-0.695 (1.184)
	β	-0.170 (0.215)	0.928 (0.543)	0.024 (0.392)	-0.391 (1.718)	-0.820 (1.412)
	n	23	17	22	9	10
USA	α	-0.160 (0.179)	-0.275 (0.233)	-0.319 (0.307)	1.035 (0.809)	-1.167 (0.817)
	β	0.145 (0.205)	0.234 (0.492)	-0.063 (0.343)	-2.407 (1.498)	-0.615 (0.674)
	n	23	17	22	10	10

Notes
Standard errors are in parentheses.
*/**: Significant at the 0.05/0.01 level respectively.

Table 4: inflation forecast of OECD

(a) $f_{-1,t}$

		(1)	(2)	(3)	(4)	(5)
Canada	α	0.115 (0.149)	0.144 (0.144)	0.025 (0.092)	0.242 (0.186)	-0.135 (0.383)
	β	0.140 (0.175)	0.376 (0.149)*	-0.094 (0.108)	-0.230 (0.167)	-0.317 (0.550)
	n	37	35	37	16	14
France	α	-0.023 (0.097)	0.006 (0.090)	0.035 (0.061)	0.345 (0.160)*	0.219 (0.141)
	β	-0.008 (0.169)	-0.312 (0.102)**	0.173 (0.107)	-0.496 (0.304)	0.480 (0.198)*
	n	37	35	37	16	15
Germany	α	0.038 (0.080)	0.013 (0.082)	-0.004 (0.049)	-0.052 (0.106)	-0.132 (0.220)
	β	0.037 (0.159)	0.111 (0.139)	0.055 (0.097)	0.170 (0.224)	-0.161 (0.366)
	n	37	35	37	19	14
Italy	α	0.102 (0.130)	0.138 (0.135)	-0.204 (0.105)	-0.255 (0.208)	-0.393 (0.383)
	β	-0.066 (0.169)	-0.132 (0.078)	-0.034 (0.137)	0.053 (0.247)	-0.264 (0.437)
	n	37	35	37	18	12
Japan	α	-0.116 (0.156)	-0.222 (0.138)	0.197 (0.155)	0.215 (0.535)	-0.099 (0.182)
	β	0.392 (0.148)*	0.220 (0.051)**	0.425 (0.147)**	0.507 (0.420)	0.083 (0.196)
	n	37	35	37	12	25
UK	α	-0.094 (0.130)	-0.110 (0.139)	-0.374 (0.131)**	-0.241 (0.322)	-0.438 (0.402)
	β	-0.007 (0.168)	0.093 (0.079)	0.077 (0.169)	-0.101 (0.410)	0.041 (0.499)
	n	37	34	37	16	19
USA	α	-0.075 (0.060)	-0.019 (0.060)	0.030 (0.036)	0.209 (0.106)	-0.069 (0.117)
	β	0.047 (0.164)	0.179 (0.068)*	0.039 (0.096)	-0.316 (0.194)	-0.079 (0.268))
	n	35	34	36	8	15

(b) $f_{-7,t}$

		(1)	(2)	(3)	(4)	(5)
Canada	α	-0.089 (0.175)	-0.275 (0.136)	-0.097 (0.174)	1.209 (0.607)	0.983 (0.275)**
	β	0.031 (0.176)	0.343 (0.176)	-0.500 (0.178)**	-1.709 (0.448)**	1.014 (0.333)**
	n	33	23	34	10	21
France	α	0.115 (0.145)	-0.027 (0.072)	0.056 (0.108)	0.370 (0.240)	0.323 (0.218)
	β	-0.168 (0.160)	-0.192 (0.064)**	0.123 (0.120)	-0.072 (0.177)	0.877 (0.496)
	n	33	23	34	13	18
Germany	α	0.080 (0.097)	-0.018 (0.079)	0.022 (0.091)	-0.061 (0.235)	-0.400 (0.363)
	β	0.153 (0.209)	-0.044 (0.177)	-0.290 (0.153)	-0.205 (0.264)	-1.321 (0.879)
	n	33	23	34	13	11
Italy	α	0.333 (0.264)	0.074 (0.175)	-0.274 (0.192)	-0.320 (0.445)	-0.071 (0.372)
	β	0.375 (0.150)*	-0.357 (0.280)	0.051 (0.109)	0.063 (0.192)	0.289 (0.474)
	n	33	23	34	18	14
Japan	α	0.003 (0.474)	-0.305 (0.127)*	0.317 (0.189)	-0.062 (0.440)	0.466 (0.183)*
	β	-0.311 (0.170)	-0.334 (0.196)	0.055 (0.069)	0.106 (0.117)	0.073 (0.099)
	n	33	23	34	14	18
UK	α	0.189 (0.285)	-0.214 (0.157)	-0.195 (0.181)	0.106 (0.343)	-0.094 (0.500)
	β	0.266 (0.160)	-0.220 (0.209)	-0.182 (0.101)	-0.293 (0.135)	0.103 (0.477)
	n	32	23	33	14	14
USA	α	-0.125 (0.141)	-0.267 (0.137)	0.052 (0.071)	0.374 (0.172)	0.061 (0.123)
	β	0.232 (0.159)	-0.319 (0.275)	-0.173 (0.080)*	0.590 (0.198)*	-0.065 (0.132)
	n	32	23	33	15	17

Notes
Standard errors are in parentheses.
*/**: Significant at the 0.05/0.01 level respectively.

Table 4: inflation forecast of OECD (continued)

(c) $f_{-13,t}$

		(1)	(2)	(3)	(4)	(5)
Canada	α	-0.052 (0.172)	0.074 (0.122)	0.590 (0.227)*	0.202 (0.934)	0.745 (0.389)
	β	0.305 (0.222)	-0.135 (0.285)	-0.378 (0.289)	-0.017 (2.064)	-0.215 (0.324)
	n	23	17	22	10	8
France	α	-0.164 (0.203)	0.076 (0.070)	0.274 (0.113)*	0.044 (0.195)	0.327 (0.220)
	β	-0.285 (0.181)	0.363 (0.236)	0.218 (0.099)*	0.561 (0.220)*	0.165 (0.144)
	n	23	17	22	10	9
Germany	α	0.097 (0.094)	0.169 (0.095)	0.030 (0.169)	-0.010 (0.435)	0.631 (0.645)
	β	0.244 (0.212)	0.302 (0.270)	0.014 (0.387)	-0.050 (0.793)	1.615 (1.555)
	n	23	17	22	10	7
Italy	α	0.198 (0.108)	0.106 (0.129)	-0.423 (0.225)	-0.652 (0.454)	0.205 (0.542)
	β	-0.318 (0.171)	-0.028 (0.231)	0.397 (0.360)	0.606 (0.586)	1.220 (1.003)
	n	23	17	22	10	9
Japan	α	-0.367 (0.137)*	-0.229 (0.132)	0.738 (0.192)**	0.541 (0.288)	1.168 (0.464)*
	β	-0.230 (0.212)	-0.247 (0.311)	0.424 (0.295)	0.617 (0.855)	0.921 (0.594)
	n	23	17	22	7	14
UK	α	0.067 (0.150)	0.220 (0.181)	0.082 (0.189)	0.064 (0.418)	-0.365 (0.483)
	β	0.270 (0.200)	-0.015 (0.460)	-0.080 (0.246)	0.126 (0.461)	-0.804 (0.648)
	n	23	17	22	9	10
USA	α	-0.252 (0.103)*	-0.231 (0.103)*	0.534 (0.141)**	3.010 (0.754)*	0.103 (0.211)
	β	-0.306 (0.207)	0.431 (0.273)	0.629 (0.276)*	-5.745 (1.986)*	0.028 (0.350)
	n	23	17	22	7	13

Notes
Standard errors are in parentheses.
*/**: Significant at the 0.05/0.01 level respectively.

Table 5: Summary

	IMF				OECD					
	GDP		inflation		GDP			inflation		
	$f_{-2,t}$	$f_{-8,t}$	$f_{-2,t}$	$f_{-8,t}$	$f_{-1,t}$	$f_{-7,t}$	$f_{-13,t}$	$f_{-1,t}$	$f_{-7,t}$	$f_{-13,t}$
Canada			○				○			
France		○				○	○			
Germany	○	○		○	○	○	○	○	○	○
Italy	○		○	○	○		○	○		○
Japan							○			
UK	○	○	○	○		○	○		○	○
USA		○			○	○	○			
Total [a]	3	4	3	3	3	4	7	2	2	3

Notes
○ indicates the forecast series for which the null of rationality is not rejected in any equation at the 0.05 significance.
a: The number of G7 countries for which the null of rationality is not rejected in any equation of the corresponding forecast series at the 0.05 significance.