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How do the OECD Growth Projections for the G7 Economies Perform? A Post-Mortem

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Abstract

How do the OECD growth projections for the G7 economies perform? A post-mortem

The quality of the OECD's *Economic Outlook* growth projections was last evaluated in-house at the peak of the previous business cycle, calling for a reassessment. This paper analyses the OECD's annual GDP growth projections for the G7 countries over the period 1991-2006 and compares them with the Consensus Economics forecasts. It shows that OECD growth projections display a number of desirable features: projections for the current year are unbiased and efficient; projection errors tend to shrink as the horizon shortens; and projections are directionally accurate most of the time. Like those produced elsewhere, the OECD projections also suffer from shortcomings: one-year-ahead projections display a positive bias, mainly reflecting a propensity to overpredict during slowdowns; spring one-year-ahead projections are far less informative than autumn ones; and turning points are poorly anticipated one year ahead. Regression tests suggest that the OECD and Consensus add value to naïve forecasts for spring current-year and autumn one-year-ahead projections.

JEL classification: E17; E27; E37

Key words: forecasts; projections; economic outlook; GDP; growth

Résumé

Les projections de croissance de l'OCDE pour les pays du G7 : une analyse post mortem

La dernière évaluation interne de la qualité des projections de croissance présentées dans les *Perspectives économiques* de l'OCDE remonte au pic du cycle précédent. Le temps est donc venu d'un réexamen. La présente étude analyse les projections de l'OCDE pour la croissance annuelle du PIB dans les pays du G7 sur la période 1991-2006 et les compare aux prévisions de Consensus Economics. Elle montre que les projections de l'OCDE possèdent un certain nombre de bonnes propriétés : celles pour l'année en cours sont non-biaisées et efficaces; les erreurs de projection ont tendance à diminuer à mesure que l'horizon de la projection se rapproche ; et dans la plupart des cas les projections anticipent correctement les ralentissements et accélérations de l'activité. Néanmoins, comme celles produites ailleurs, les projections ont aussi leurs limites : celles pour l'année suivante présentent un biais positif, reflétant principalement une propension à surestimer la croissance en phase de ralentissement; les projections de printemps pour l'année suivante sont beaucoup moins informatives que celles produites à l'automne; et les points de retournement sont rarement anticipés un an plus tôt. L'analyse économétrique montre que les projections de l'OCDE ainsi que les prévisions de Consensus Economics apportent de la valeur ajoutée aux projections naïves dans le cas des projections de printemps pour l'année en cours et des projections de l'automne pour l'année suivante.

Classification JEL: E17 ; E27 ; E37

Mots clés: prévisions ; projections ; perspectives économiques ; PIB ; croissance

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HOW DO THE OECD GROWTH PROJECTIONS FOR THE G7 ECONOMIES PERFORM? A POST-MORTEM[1]

By Lukas Vogel

1. Introduction and summary

1. The quality of the OECD's *Economic Outlook* (EO) growth projections was last comprehensively assessed in-house at the peak of the cycle that ended the past millennium (by Koutsogeorgopoulou, 2000). One global slowdown and several years into a global expansion later, it is time to revisit this issue.[2]

2. This paper focuses on projections of annual GDP growth in the G7 countries over the past 16 years for which the necessary data are now available, *i.e.* the period 1991-2006. It treats spring and autumn EO releases separately, because the corresponding forecast horizons differ. The tests compare EO projections over three different horizons: the projections in spring for the current year, the projections in autumn for the year ahead, and the projections in spring for the year ahead.[3]

3. The projections are compared to first realisations, which is the outcome as reported in the spring EO that follows the year the projection was made for. Realised 2006 GDP growth thus equals the value for 2006 reported in the spring 2007 EO. If data get revised, the choice of realisation to compare the forecast with is crucial. Comparing all projections to the first reported value for the realisation avoids mixing the question of forecast quality with problems of data revision when comparing results across different forecast horizons.[4]

4. The paper reviews key criteria to assess the quality of economic forecasts and applies them to the EO GDP growth projections for the G7 countries. The main findings are:

- EO growth projections for the G7 display a number of desirable features. In particular, current year projections are unbiased and efficient, and projection errors do tend to shrink as more information becomes available. Autumn projections for the year ahead are less accurate and have a positive bias, however. Spring EO one-year ahead projections are far less informative. The positive bias in autumn one-year-ahead projections primarily stems from a delayed and incomplete downward revision of projections during slowdowns, while spring one-year-ahead projections tend to

[1] Kind data provision by Debra Bloch, Vivian Koutsogeorgopoulou and Jef Vuchelen is gratefully acknowledged. I would like to thank Rudiger Ahrend, Christophe André, Sebastian Barnes, Jean-Philippe Cotis, Romain Duval, Jørgen Elmeskov, Felix Hüfner, Vincent Koen, Isabell Koske, Vivian Koutsogeorgopoulou and Peter Tulip for their helpful and stimulating comments and suggestions.

[2] The IMF has recently undertaken a thorough assessment of its *World Economic Outlook* projections (Timmermann, 2006).

[3] The autumn EO also contains two-year-ahead projections, but these are not included in the analysis because no corresponding Consensus forecast is available for comparison.

[4] Data revisions can be large. For instance, in March 2007, 2005 real GDP growth for Japan was revised down from the 2.7% reported in the spring 2006 EO to 2.2%. Also, in recent years, real GDP data for the euro area and the United Kingdom have been fairly systematically revised upwards following the publication of the first estimates, and US ones downwards, a point to bear in mind when assessing country-specific projection biases.

persistently overestimate the outcome during low-growth episodes and show little sensitivity to initial cyclical conditions.

- Spring current-year and autumn one-year-ahead projections add value to naïve forecasts, such as the sample mean or previous realisations. Moreover, EO projections for the current year tend to outperform the respective Consensus Economics (CE) ones.

- While EO projections are directionally accurate most of the time, they tend to fail to anticipate turning points one year ahead. However, these and other limitations are not specific to EO projections and are also attached to other forecasts.

2. Criteria for forecast quality

5. The quality of forecasts is assessed based on their unbiasedness, accuracy and efficiency. More precisely, the following criteria are used:

1. Forecasts should be unbiased;
2. The forecast errors should be small;
3. The variance of forecast errors should decline as the forecast horizon shortens;
4. The errors should be unpredictable;
5. The forecast revisions should be unpredictable;
6. The forecasts should provide information additional to that contained in alternative ones;
7. They should be directionally accurate;
8. The forecasts should accurately predict turning points in the actual series.

The first two criteria, *i.e.* absence of bias and small forecast errors, represent fundamental goals. The remaining criteria are essentially means of achieving these two goals.

6. Alternative forecasts provide an obvious benchmark to evaluate forecast quality. Some studies have suggested that individual private or average Consensus forecasts outperform OECD or IMF projections (Batchelor, 2000; Blix *et al*., 2001).[5] Timmermann (2006) rejects this conclusion with regard to recent IMF projections. He does not find systematic evidence that accounting for the information in the Consensus would have generally improved IMF projections over the period 1990-2003.

7. This paper compares EO projections to the average forecasts published monthly by CE. Specifically, it compares the spring EO projection to the May CE and the autumn EO projection to the November CE, with a view to minimising the time and information gap between both forecasts. The timing assumption departs from Batchelor (2000) and Blix *et al*. (2001).[6]

8. Inference in this note draws on a relatively small sample: the G7 over the period 1991-2006, which gives 112 observations and focuses on a fairly limited period of cyclical fluctuations. At the same

[5] An OECD reply at the time was Lenain (2001).

[6] It is important to note that working-day adjustment differs across the forecasts included in the CE, whereas both EO projections and realisations are working-day adjusted. The incomplete working-day correction of GDP growth forecasts a priori weakens the CE when compared to realisations with working-day adjustment. Furthermore, some CE forecasters do not update regularly. Consequently, some of the CE components could rely on outdated information. CE forecasts released at the same time may then suffer from an informational disadvantage relative to the EO.

time, this limitation allows focusing on the performance of the most recent vintages of EO projections.[7] Last but not least, the status of the OECD projections, which in some ways are more conditional than private sector forecasts, ought to be borne in mind (Box 1).

Box 1. The status of OECD economic projections

Twice a year, the OECD's Economics Department produces a full set of macroeconomic forecasts 18 months to two years out. These include projections for key macroeconomic variables in each of it 30 Member countries as well as international trade and payments, and broad developments in key non-OECD economies and regions. In the process, individual country and regional assessments are made under a consistent set of assumptions, giving particular attention to international consistency in trade and financial developments. Importantly, the OECD projections and the accompanying analysis are meant to frame the policy debate in Member countries.

The OECD's macroeconomic projections are best described as "conditional" rather than "pure" forecasts, as they depend on specific sets of assumptions about macroeconomic and structural policies, exchange rates and world commodity prices. Fiscal policy assumptions are based on current legislation as well as announced measures and stated policy intentions where they are embodied in well-defined programs with legislative support. Monetary policies are assumed to be set in line with stated objectives, notably as regards maintaining or achieving low inflation. Nominal exchange rates against the US dollar are generally assumed to remain constant at the level prevailing on a pre-specified cut-off date. Crude oil prices are typically assumed to remain constant in nominal terms based on average prices during the period leading up to the cut-off date; other commodity prices are typically assumed to remain constant in real terms.

The projections draw on a combination of analytical methods and expert judgment, involving a broad exchange of views among OECD country experts and topic specialists, and taking into account estimates based on econometric models of key macroeconomic relationships. International consistency is ensured through the use of OECD's world trade model (Pain *et al.*, 2005) and discussions between country and trade specialists.

In assessing the current near-term situation, particular weight is also given to separate models that make use of high-frequency indicators to provide estimates of GDP growth in the major OECD economies in the two quarters following the last quarter for which data has been published (Sédillot and Pain, 2005; Mourougane, 2006). These models incorporate high-frequency information released before the official national accounts data, including "soft" indicators, such as business and consumer surveys, and "hard" indicators, such as industrial production and retail sales.

Further input is provided by discussions with Member country government experts and economic forecasters. Whilst giving due consideration to the comments and suggestions from Member countries, the projections and analysis published in the *Economic Outlook* reflect the independent assessment of world economic conditions by the OECD staff economists.

Additional details can be found at www.oecd.org/oecdeconomicoutlook and www.oecd.org/eco/sources-and-methods.

3. Tests

9. A good forecast should be unbiased and display small errors. It should incorporate all relevant information to this end, so that forecast errors and revisions are random. Summary statistics and regression analysis suggest that the OECD projections fulfil these criteria only partly.

[7] A first assessment by Bowles *et al.* (2007) of the ECB Survey of Professional Forecasters (SPF) suggests accounting for the distribution of macroeconomic shocks when assessing the projections. It argues that much of the bias in SPF growth projections results from a sequence of asymmetric and unpredictable shocks to the euro area, rather than from distorted judgement. This paper focuses on both broader cross-sectional and time dimensions, which should strengthen the robustness of its inference for G7 countries compared to the early assessment of the SPF, however.

Projections for the current year are unbiased, but one-year-ahead ones have positive bias

10. While growth projections for the current year are unbiased, average one-year-ahead ones have a tendency to overestimate the outcome. Bias shows up as non-zero average error. Table 1 reports mean projection errors and the percentage of over-predictions, *i.e.* positive errors, for the three forecast horizons, which increase from column 1 to 3. The table illustrates a positive bias in one-year-ahead projections. The bias is strongest for spring EO one-year-ahead projections, which is the longest forecast horizon considered here. As a benchmark, we also report CE forecasts, which display a similar bias.[8]

Table 1: Projection bias

A. Average forecast error in percentage points of GDP

Country	Spring current year		Autumn one year ahead		Spring one year ahead	
	EO	CE	EO	CE	EO	CE
Canada	0.26	0.15	0.40	0.32	0.87	0.58
France	0.08	0.14	0.37	0.36	0.81	0.75
Germany	-0.07	-0.14	0.39	0.28	0.83	0.63
Italy	0.19	0.30	0.60	0.62	1.11	1.05
Japan	0.05	-0.08	0.31	0.19	0.84	0.74
United Kingdom	-0.02	0.04	0.26	0.27	0.48	0.50
United States	-0.02	-0.03	-0.38	-0.41	-0.10	-0.13
Average	**0.07**	**0.05**	**0.28**	**0.23**	**0.69**	**0.59**

B. Frequency of over-predictions in per cent of total number of projections

Country	Spring current year		Autumn one year ahead		Spring one year ahead	
	EO	CE	EO	CE	EO	CE
Canada	63	56	69	69	69	63
France	63	56	69	56	63	69
Germany	50	44	69	63	75	63
Italy	56	63	69	69	75	75
Japan	56	56	38	44	63	56
United Kingdom	44	63	50	63	63	63
United States	44	44	38	31	56	56
Average	**54**	**54**	**57**	**56**	**66**	**63**

Source: Consensus Economics, OECD Economic Outlook database, own calculations.

11. Regressing the forecast error E on a constant α tests for the statistical significance of the bias:

$$E_t = \alpha + \varepsilon_t \quad (1)$$

Unbiasedness of projections requires $\alpha = 0$.

12. Table 2 reports the estimates of equation (1) over the period 1991-2006. The regression pools the data for the G7 countries and uses the White estimator to correct for heteroskedasticity and serial correlation in the residuals (see *e.g.* Greene, 2000). Robust standard errors for the coefficient estimates are reported in parentheses. The asterisks indicate the rejection of the null hypothesis of a zero coefficient value at 10%, 5% and 1% significance levels, respectively. The table also provides test statistics for the

[8] Glueck and Schleicher (2005) also find a common bias in OECD and IMF projections.

joint insignificance of country fixed effects, *i.e.* country-specific bias, the absence of serial correlation in residuals (Box-Ljung), and the normal distribution of residuals (Jarque-Bera) as null hypotheses.[9]

Table 2: Testing for bias in EO projections

EO projection	**Spring current year**	**Autumn one year ahead**	**Spring one year ahead**
α	0.07 (0.04)	0.28 (0.11)**	0.69 (0.14)***
Country dummies (p-value)	0.87	0.46	0.37
Country dummies	No	No	No
R^2	0.00	0.00	0.00
Durbin-Watson statistic	2.16	2.05	1.53
Box-Ljung AR 1 (p-value)	0.55	0.77	0.04**
Box-Ljung AR 2 (p-value)	0.23	0.92	0.12
Jarque-Bera (p-value)	0.53	0.36	0.43
Number of observations	112	112	112

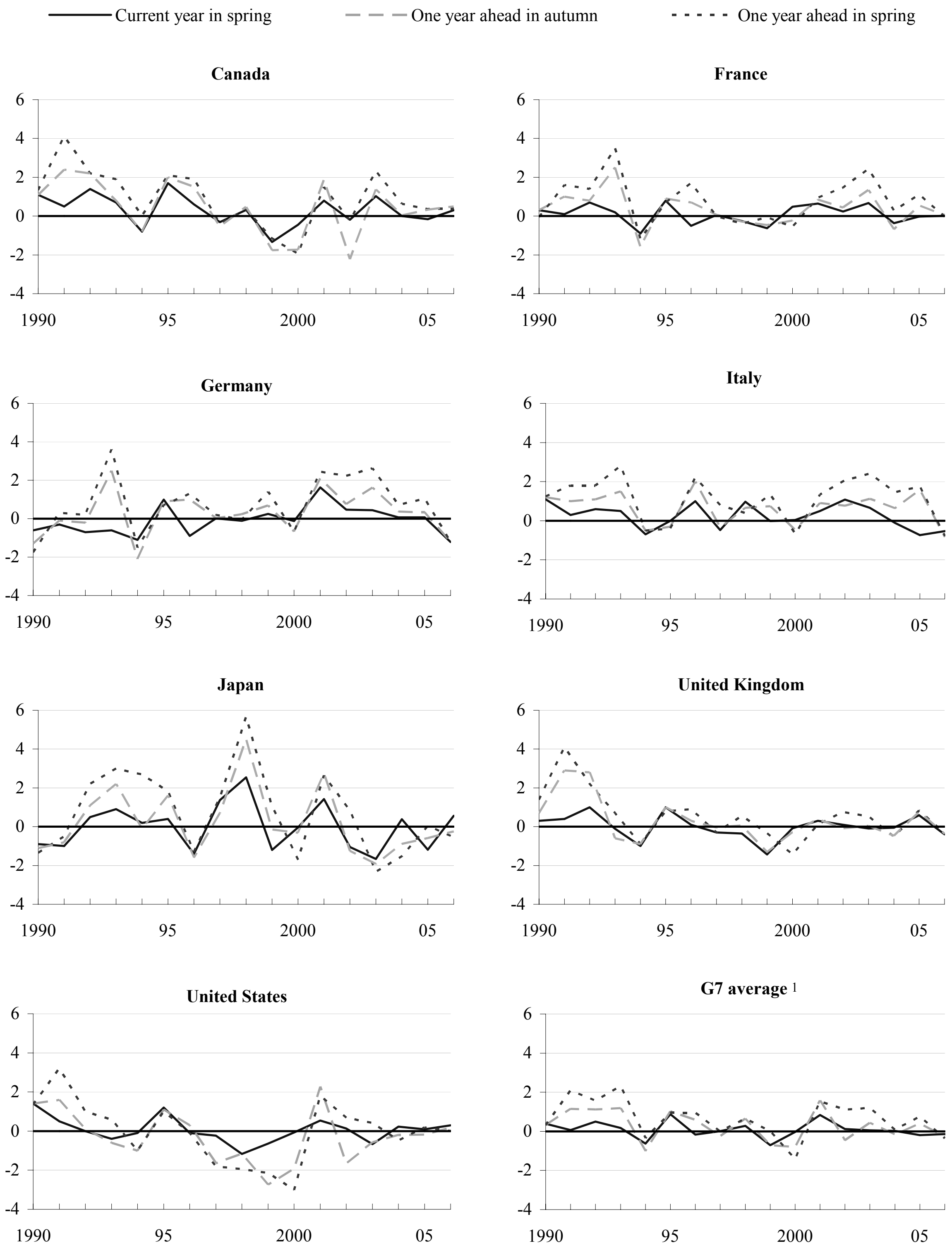
*, ** and *** denote significance at the 10%, 5% and 1% levels respectively. Robust standard errors reported in parentheses.
Source: Author's estimates.

13. The results in Table 2 confirm the conclusion from Table 1. On average, spring EO current-year projections have no significant bias, but one-year-ahead projections have a positive one. The bias is strongest for spring EO one-year-ahead projections in the spring EO, *i.e.* the most distant horizon, attaining 0.7 percentage point. Joint insignificance of fixed effects is not rejected, suggesting that country differences in projection bias are not statistically significant.

14. Figure 1 provides a picture of EO projection errors at the country level and across time. One-year-ahead projection errors are predominantly above zero, which is the visual equivalent to the results in Table 1 and 2. The charts also suggest that, for continental European countries, errors in one-year-ahead projections were especially pronounced at both the beginning and the end of the sample period. Table A.1 in the annex indicates a weak correlation of projection errors across countries. Error correlation appears substantial only in a very limited number of cases and for the longer projection horizons.

[9] The significance of country fixed effects is tested throughout the analysis. When the F-test does not reject the joint insignificance of country fixed effects, the respective equation is re-estimated without fixed effects in order to preserve degrees of freedom. In these cases, the tables report estimates from the regression without fixed effects. When the F-test rejects the joint insignificance of country dummies, the latter are maintained and the estimates for the equation with fixed effects are reported.

Figure 1: The evolution over time of EO projection errors



1. Unweighted average of G7 countries.
Source: OECD Economic Outlook database, own calculations.

15. The Figures A.1 to A.3 in the annex offer some informal comparison of the performance of EO and CE projections across countries and over time. EO and CE current-year projections both capture well the volatility of GDP growth. In contrast, one-year-ahead projections in spring are substantially flatter than realisations. In addition, the charts show EO and CE projections to move closely together over all three projection horizons. One-year-ahead projections for Japan are among the rare exceptions.

16. The Figures A.1 to A.3 also provide insights on the sources of the bias highlighted in Table 2. Spring EO projections for the current year, which are unbiased, track real GDP growth well (A.1). Autumn EO one-year-ahead projections have a tendency to overestimate growth especially when the economy is slowing down (A.2). Except for the United States, the overestimation during downswings dominates the sample, as it is stronger than the underestimation witnessed during upturns. Projections follow the deceleration in activity with some delay and are not revised downwards by the full amount. Despite the fluctuations in actual growth, spring EO one-year-ahead projections have been very stable irrespective of the cyclical starting point (A.3). Spring one-year-ahead projections for continental European countries have tended to be achieved only at the peak of the cycle. This suggests the possible existence of a combined issue of overestimation of trend output and lack of sensitivity to cyclical positions, *i.e.* insufficient attention to levels of potential output, at this projection horizon. As a result, there is substantial error persistence for this group of countries during lasting low-growth episodes. The econometric estimates in Table A.2 in the annex confirm the asymmetry of error persistence for spring EO one-year-ahead projections.

Errors are small for current-year, but large for one-year-ahead projections

17. The second fundamental goal of forecasters is to keep projection errors small. A forecast with little error is an accurate forecast. An accurate forecast correctly anticipates much of the variation in the realisation that it attempts to project. A straightforward measure is the amount of variance in the realisation that the projection correctly predicts, or the size of the error compared to the volatility of the realisation.

18. The R^2 is an important and common metric for the accuracy of projections, or the predictability of realisations (see Campbell, 2004).[10] It relates the mean squared error to the variance of the realisation

$$R^2 = 1 - \frac{\sum_{t=1}^{T} E_t^2}{\sum_{t=1}^{T}\left(X_t - \overline{X}\right)^2} \qquad (2)$$

The R^2 measures the percentage share of variance in the realisation that the projection correctly accounts for. A perfect forecast has zero error and $R^2=1$.

19. Table 3 reports the R^2 of the G7 countries and indicates major differences in accuracy across the three projection horizons. The predictive value of spring current-year projections is high, and on average the EO projections outperform CE forecasts on this account. The R^2 strongly declines for one-year-ahead projections in autumn. It is close to zero for a number of countries, and even negative in the case of Italy. The one-year-ahead projections in spring even have a negative R^2, except for the United Kingdom.[11]

[10] Under the assumption that forecasts make the best possible use of the available information, the R^2 can also be interpreted as measuring the *predictability* of final outcomes (see Tulip, 2005).

[11] One should bear in mind that country differences in R^2 strongly depend on the quality of first data releases, which are our benchmark to compare the projections with. In our analysis, a forecast that strongly differs from first releases of national accounts' data has a strong projection error attached, even if the projection comes close to revised data later on. Some forecasters may wish and be able to anticipate data revisions. Consequently, the present analysis may unduly penalise forecasters for errors in initial national accounts' data, which may vary across countries.

Table 3: R-squared of projections

Country	Spring current year		Autumn one year ahead		Spring one year ahead	
	EO	CE	EO	CE	EO	CE
Canada	0.72	0.73	0.08	0.10	-0.22	0.03
France	0.78	0.68	0.13	-0.05	-0.80	-0.68
Germany	0.67	0.57	0.14	0.18	-0.55	-0.52
Italy	0.61	0.53	-0.04	-0.14	-1.57	-1.34
Japan	0.56	0.50	0.05	0.04	-0.63	-0.55
United Kingdom	0.83	0.80	0.38	0.37	0.17	0.02
United States	0.86	0.88	0.10	0.27	-0.20	-0.06
Average	**0.72**	**0.67**	**0.12**	**0.11**	**-0.54**	**-0.44**

Source: Consensus Economics, OECD Economic Outlook database, own calculations.

20. Close-to-zero values of the R^2 mean that squared projection errors have been similar to the variance of realisations. Negative values of R^2 imply that squared projection errors have even been greater than the variance of actual GDP growth. In these cases, the sample mean was an equally or even more accurate guide to GDP growth than the respective projections. Given the mean of realisations, the projection is uninformative, for $R^2=0$, or even misleading, for $R^2<0$ (see Tulip, 2005).[12] Table 3 is compatible with Campbell (2004) and Tulip (2005), who find a declining accuracy of US forecasts in recent years, compared to both initial and revised GDP data.

Projections for the current year are efficient, but one-year-ahead projections are not

21. Another way of looking at the information value of projections is to regress the realisation, X, on the projection, P, and a constant:

$$X_t = \alpha + \beta P_t + \varepsilon_t \tag{3}$$

Uninformative forecasts have $\beta=0$. With $\beta<0$, the projection is even misleading. At the other extreme, a forecast that incorporates all available information is said to be efficient. Efficiency requires $\alpha = 0$, $\beta = 1$ and white-noise residuals ε in equation (3). The reduction of bias and error size brings forecasts closer to efficiency. If residuals in (3) were serially correlated, one should exploit their non-random pattern to improve the forecast. Equally, non-zero values of α should be incorporated directly into the forecast.

22. Table 4 reports the estimates of equation (3) for the sample of G7 economies. As before, it uses the White estimator and reports robust standard errors for the coefficients and test statistics for the joint insignificance of country fixed effects, the absence of residual autocorrelation, and normally distributed residuals as the null hypotheses.

23. The results in Table 4 indicate that spring EO current-year and autumn EO one-year-ahead projections have information value. The estimate of β is significantly positive in both cases. Conversely, one-year-ahead projections in the spring EO are uninformative, on average, which strengthens the finding of negative R^2 in Table 3.[13]

[12] However, a higher predictive value of the sample mean does not suggest forecasters should focus on the sample mean. The sample mean is known only *ex post*. Projecting outcomes, the forecaster only knows the historic mean, *i.e.* the mean up to the time of the projection. See Tulip (2005) for a comparison of Fed GDP projections with historical means.

[13] Extending the sample back to the 1970s would increase the average predictive value of the projections. For spring one-year-ahead projections one obtains β close to 0.5 and significant at the 1% level. This estimate, which differs

Table 4: Testing for the efficiency of EO projections

EO projection	Spring current year	Autumn one year ahead	Spring one year ahead
α	-0.03 (0.08)	0.06 (0.18)	1.71 (0.42)***
β	0.98 (0.03)***	0.85 (0.07)***	0.08 (0.16)
F (α = 0, β = 1)	0.24	0.02**	0.00***
Country dummies (p-value)	0.88	0.27	0.02**
Country dummies	No	No	Yes
R^2	0.75	0.27	0.16
Durbin-Watson statistic	2.14	1.92	1.43
Box-Ljung AR 1 (p-value)	0.59	0.76	0.07*
Box-Ljung AR 2 (p-value)	0.24	0.93	0.06*
Jarque-Bera (p-value)	0.46	0.15	0.00***
Number of observations	112	112	112

*, ** and *** denote significance at the 10%, 5% and 1% levels respectively. Robust standard errors reported in parentheses.
Source: Author's estimates.

24. In addition to their significant information content, Table 4 suggests that spring EO projections for the current year are efficient: the joint restriction $\alpha = 0$ and $\beta = 1$ and the assumption of white-noise residuals are not rejected. The estimates in column 2 reject the efficiency of autumn EO one-year-ahead projections, however. Column 3 clearly rejects the efficiency of spring EO one-year-ahead projections.[14]

25. Throughout the analysis, we report estimates for equations without fixed effects, if fixed effects are jointly insignificant, or with fixed effects, if the joint insignificance of fixed effects is rejected. Only in the case of the spring EO one-year-ahead equation are country fixed effects significant. Checking both specifications is potentially interesting, however, for the interpretation of the estimates. Indeed, re-estimating column 3 without fixed effects gives β=0.39, which is significant at the 1% level. The economic interpretation of the result is that spring one-year-ahead projections outperform the G7 mean of realisations as a predictor, but not the individual country means.

26. Conversely, adding fixed effects to the specification does not dilute the significance of projections in column 1 and 2. Now, the coefficient estimates are β=0.99 and β=0.73, respectively. Both are significant at the 1% level. Economically speaking, this means that spring current-year and autumn one-year-ahead projections outperform both the G7 average and individual country means of realisations as predictors.

27. In sum, spring EO projections for the current year are efficient, *i.e.* capture the available systematic information, whereas EO growth projections for the G7 one year ahead are inefficient. Nevertheless, the rejection of β=0 in the column 2 – irrespective of the introduction of fixed effects – means that autumn one-year-ahead projections, though not efficient, still provide useful information. Contrary to spring one-year-ahead predictions, they outperform country means of realisations as a predictor of GDP growth.[15]

from the one in column 3 of Table 4, extends the finding of the deterioration over time of Fed projections for the US economy (see Tulip, 2005) to OECD growth projections for G7 economies.

[14] The Box-Ljung and Jarque-Bera statistics also indicate residual autocorrelation and non-normality in the latter case.

[15] The regression $E_t=\alpha+\beta E_{t-1}+\varepsilon_t$ provides an alternative test for forecast efficiency. An efficient projection has α=0 and β=0 (Carnot *et al.*, 2005). Taking into account potential bias or serial correlation of forecast errors would otherwise improve the projection. For our sample, the estimates confirm the results in Tables 2 and 4: unbiasedness and

Projection errors become smaller as the horizon shortens

28. A prerequisite for small forecast errors and the efficiency of forecasts is that forecast errors should diminish with the shortening of forecast horizons. Forecast accuracy should improve as more relevant information becomes available. Figure 1 and Table 3 have already presented ample evidence for the accuracy gain associated with the shortening of the projection horizon. In addition, Table 5 provides the root mean square error (RMSE), the square root of the average squared error, as a standard measure of forecast accuracy (see *e.g.* Carnot *et al*., 2005; Timmermann, 2006; West, 2006).

Table 5: Root mean square error

Country	Spring current year	Autumn one year ahead	Spring one year ahead
Canada	0.81	1.49	1.71
France	0.50	0.99	1.42
Germany	0.73	1.19	1.60
Italy	0.61	1.01	1.59
Japan	1.17	1.71	2.24
United Kingdom	0.62	1.16	1.34
United States	0.54	1.34	1.55
Average	**0.71**	**1.27**	**1.64**

Source: Consensus Economics, OECD Economic Outlook database, own calculations.

29. Table 5 illustrates that the EO projections for GDP growth in G7 countries fulfil the requirement of declining errors both on average and at the country level. Going from column 3 to 1, the size of absolute errors clearly diminishes, *i.e.* projections become more precise. The smaller RMSE for shorter projection horizons is in line with the higher R^2 in Table 3.[16]

30. Tables 3 and 5 assess the average accuracy of country and G7 average projections over the time period 1991-2005. Figure 2 looks at the evolution of accuracy over time. It plots 5-year rolling windows of the error size - measured by the RMSE - and the standard deviation of the growth realisation. The charts indicate that GDP growth has become more predictable on average, as indicated by declining standard deviations of growth rates. Projection errors have tended to decline with declining volatility of GDP realisations. Overall, Figure 2 suggests that the average accuracy of EO growth projections for the G7 has increased in line with the decline of volatility in GDP growth since the beginning of the 1990s. Therefore, the relative performance of projections can be described as fairly stable.[17]

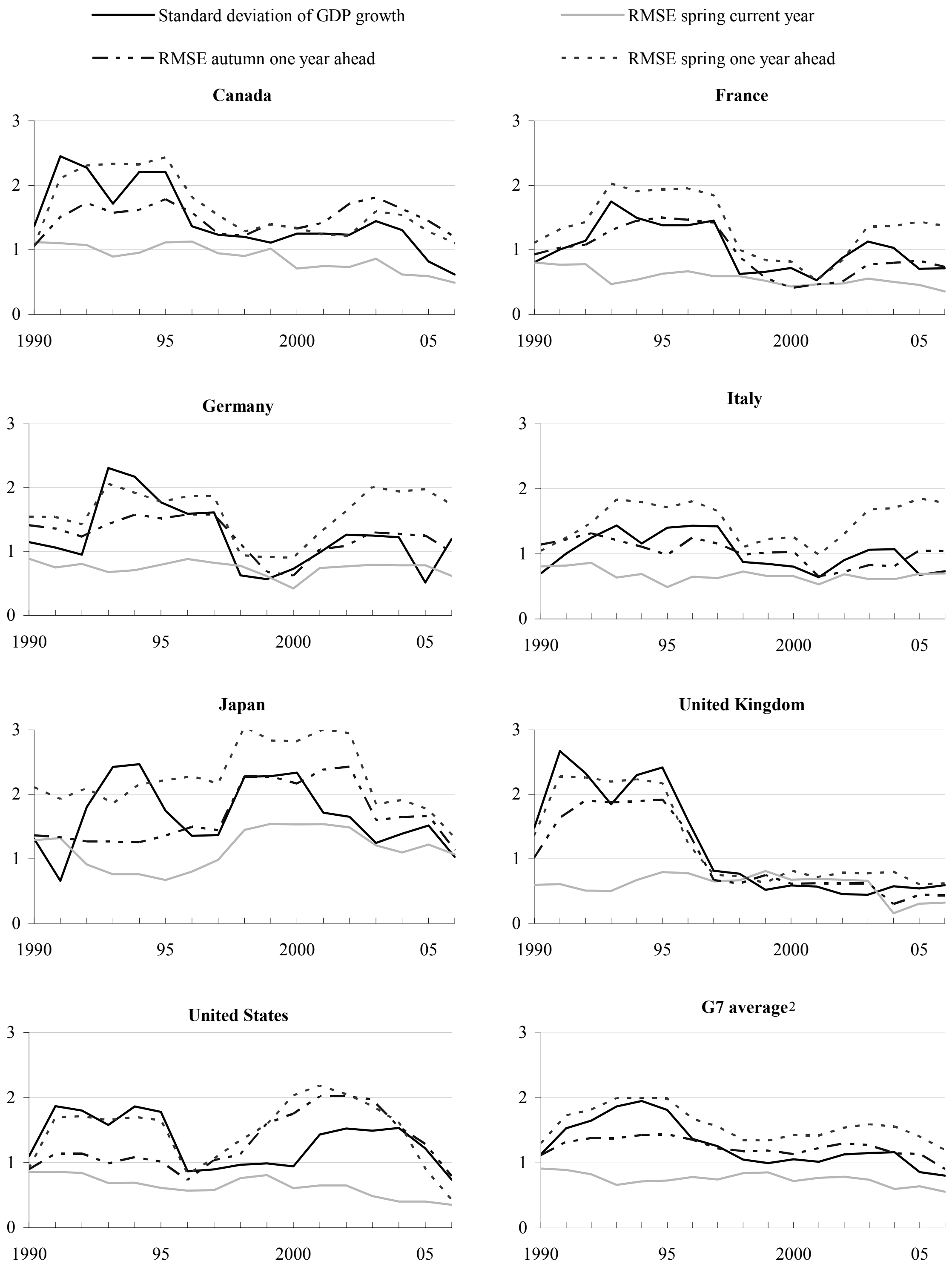
efficiency of spring current-year projections, positive bias in autumn one-year-ahead projections, and positive bias as well as autocorrelation in spring one-year-ahead projection errors.

[16] Mean absolute errors (MAE) as an alternative accuracy measure lead to the same conclusion. Both RMSE and MAE put equal weight on over- and under-predictions. Consequently, RMSE- or MAE-based evaluations of forecast accuracy assume the loss function for projection errors to be symmetric. Both measures differ in that the MAE treats all errors uniformly, whereas the RMSE gives higher weight to larger errors. MAE and RMSE are thus compatible with linear and quadratic loss functions, respectively. Cross-country comparison of forecasting performance would have to adjust the RMSE or MAE by the standard deviation of realisations in each country. Table 3 already provides the similar and more informative R^2 to compare projections across countries.

[17] Figure 2 also shows some variation in the relative performance of spring current-year, autumn one-year-ahead and spring one-year-ahead projections. The RMSE of spring EO current-year projections tends to be substantially lower than the volatility of actual growth. This corresponds to the high and positive R^2 of current-year projections in Table 3. In contrast, spring EO one-year-ahead predictions tend to have RMSE values above the volatility of actual growth, which is in line with the negative R^2 values for this projection horizon in Table 3.

Figure 2: Volatility of GDP growth and projection accuracy over time

5-year windows [1]



1. Data points are for 5-year rolling windows ending in year t. E.g., the RMSE in 2006 is the RMSE for the period 2002-06.
2. Unweighted average of G7 countries.
Source: OECD Economic Outlook database, own calculations.

Following the CE more closely would not systematically improve EO projections

31. Making the smallest possible error requires forecasters to use the most of available systematic information. If forecasts are optimal in their use of available information, forecasts errors cannot be predicted. Table 4 has already shown this requirement to be violated for spring EO one-year-ahead projections, for which errors are serially correlated. In this case, the lagged projection error conveys information about the current one, and forecasters using this information could improve their projection.

32. This may not be the only source or sign of relevant, but neglected information. In principle, no currently available information should help to predict the errors in current or future projections. Given the huge information set, the search of predictors is open-ended and any variable with potential influence on future growth could a priori be tested. Instead of testing the explanatory value of various data that forecasters may have neglected, the regression

$$E_t^{EO} = \alpha + \beta\left(P_t^{CE} - P_t^{EO}\right) + \varepsilon_t \tag{4}$$

looks at whether projection errors are correlated with deviations of the EO from the CE as an alternative forecast. In the equation, E^{EO} is the EO projection error and P^{CE} - P^{EO} the difference between CE and EO projections. If β=0, deviating from CE neither improves nor deteriorates forecast accuracy, on average. As before, we test for the insignificance of country fixed effects and use the White estimator for unbiased and consistent standard errors.[18]

33. The estimates in Table 6 suggest that deviations from the respective CE of spring EO projections for the current year and autumn EO projections for the year ahead do not systematically affect the accuracy of EO projections. In the case of spring one-year-ahead predictions, the estimate of β is significantly negative at the 10% level. The latter implies that less deviation from the CE would reduce EO projection errors. Tables 3 and 10, however, indicate that CE one-year-ahead projections in spring are uninformative themselves, compared to the sample mean of realisations. Consequently, being closer to the CE could reduce EO projection errors, but would not make the spring EO one-year-ahead projection an informative one.

Table 6: Regressing EO projection errors on forecasts differentials

EO projection	**Spring current year**	**Autumn one year ahead**	**Spring one year ahead**
α	0.07 (0.04)	0.26 (0.13)**	0.62 (0.15)***
β	-0.05 (0.15)	-0.42 (0.44)	-0.70 (0.36)*
Country dummies (p-value)	0.88	0.46	0.45
Country dummies	No	No	No
R^2	0.00	0.01	0.02
Durbin-Watson statistic	2.16	2.05	1.51
Box-Ljung AR 1 (p-value)	0.52	0.79	0.03**
Box-Ljung AR 2 (p-value)	0.24	0.85	0.09*
Jarque-Bera (p-value)	0.56	0.42	0.29
Number of observations	112	112	112

*, ** and *** denote significance at the 10%, 5% and 1% levels respectively. Robust standard errors reported in parentheses.
Source: Author's estimates.

[18] Paragraph 16 suggests that it would be interesting to formally investigate the relationship between growth projections and cyclical positions, *i.e.* between projections or projection errors and the output gap. Unfortunately, real-time data on output gaps is available only for part of the sample period. Comprehensive data is available only as *ex-post* estimates, which have been heavily revised over time. Hence, these data on cyclical positions cannot be considered part of the forecaster's information set. Any cross-country comparison based on the shorter sub-sample could only provide very preliminary results.

34. The reverse regression of CE forecast errors on the difference between CE and EO projections and a constant brings to light a similar bias in the CE compared to the EO projections. In addition, the regression provides a significantly positive β for spring current-year projections. The point estimate of β=0.95 suggests that any deviation of the spring CE for the current year from the corresponding EO projection will (almost) entirely translate into higher CE projection errors.[19]

Projection revisions have a tendency towards downward corrections, but adjustment is not that slow

35. A further aspect of, and requirement for, small and random projection errors is that forecast revisions should not be predictable. If revisions had a significant upward or downward bias, forecasters should have incorporated it in their information set, adjusting the initial forecast accordingly. To test for the random nature of revisions we simply regress the forecast revision on a constant:

$$\Delta P_t = \alpha + \varepsilon_t \,. \tag{5}$$

The null hypothesis of unsystematic revisions requires α = 0.[20]

36. Two series of revisions are available: revisions of spring EO one-year-ahead projections in the autumn EO of the same year, and revisions of one-year-ahead projections in autumn in the current-year projections of the subsequent spring EO. Table 7 provides significantly negative values of α in both cases, which indicates that revisions are not random and display a significant downward trend. This is hardly surprising, since tables 1 and 2 already showed that the positive projection bias diminishes as the projection horizon shortens. Autumn one-year-ahead projections are on average 0.4 percentage points below one-year-ahead projections in the preceding spring EO, and spring EO current-year projections are 0.2 percentage point lower than autumn one-year-ahead projections. Consequently, projection revisions do not meet the criterion of randomness.[21]

Table 7: EO projection revisions

EO projection	Revision from spring to autumn one-year-ahead projection	Revision from autumn one-year-ahead to spring current-year projection
α	-0.41 (0.04)***	-0.21 (0.10)**
Country dummies (p-value)	0.86	0.17
Country dummies	No	No
R^2	0.00	0.00
Durbin-Watson statistic	1.98	2.17
Box-Ljung AR 1 (p-value)	0.88	0.34
Box-Ljung AR 2 (p-value)	0.24	0.44
Jarque-Bera (p-value)	0.05**	0.00***
Number of observations	112	112

*, ** and *** denote significance at the 10%, 5% and 1% levels respectively. Robust standard errors reported in parentheses.
Source: Author's estimates.

[19] See Table A.2 in the annex for the estimates.

[20] One could also add more of the information available at the outset. Timmermann (2006) tries out US and German GDP growth, oil-price and current-account forecasts, to investigate their impact on the revision.

[21] Given the limited sample size, the negative revision bias does not necessarily imply that distant EO projections are intrinsically over-optimistic. Forecasters confronting new, pessimistic information should revise the projections downwards. Only if new information had been neutral - or positive - on average, would the trend in revisions cast serious doubts on the projection method. Whether this has been the case would remain to be established.

37. A related question concerns the correlation between consecutive revisions. In principle, they should be uncorrelated if new information motivating the revisions is serially uncorrelated.[22] The regression of current on past revisions

$$\Delta P_t^t = \alpha + \beta \Delta P_{t-1}^t + \varepsilon_t \tag{6}$$

provides some insight. An estimate of β=0 indicates uncorrelated revisions. If β>0, revisions are smoothed across the two intervals. If β<0, initial revisions over- or undershoot the final target. In this case, the revisions undertaken in spring for the current year would partly reverse the revisions undertaken in the previous autumn for one-year-ahead projections.

38. Table 8 displays estimates for equation (6). The significantly positive β in column 1 suggests a positive correlation between revisions of EO projections for a given year. Country fixed effects, in column 2, are jointly insignificant. Period fixed effects in column 3 are highly significant, however, and indicate that the average size of revisions has varied over time. Accounting for the time variation, the estimates in column 3 do not provide evidence for significant serial correlation of projection revisions once period-specific means of the revision size have been accounted for. Figure A.4 in the annex shows the projection revisions at country levels and corroborates the above estimates. The results provide no robust evidence for sluggish or over-active revision of EO projections and lend no support to the hypothesis that EO forecasters may be overly reluctant to revise their GDP growth estimates.

Table 8: Regressing current on preceding EO projection revisions

EO projection	Sample mean	Country-specific mean	Period-specific mean
α	-0.14 (0.07)*	-0.15 (0.04)***	-0.16 (0.13)
β	0.18 (0.09)**	0.16 (0.10)	0.14 (0.28)
Fixed effects (p-value)	-	0.20	0.00***
Country dummies	No	Yes	No
Time dummies	No	No	Yes
R^2	0.02	0.10	0.40
Durbin-Watson statistic	2.31	2.48	2.05
Box-Ljung AR 1 (p-value)	0.13	0.01***	0.90
Box-Ljung AR 2 (p-value)	0.24	0.04**	0.88
Jarque-Bera (p-value)	0.00***	0.01***	0.19
Number of observations	112	112	112

*, ** and *** denote significance at the 10%, 5% and 1% levels respectively. Robust standard errors reported in parentheses.
Source: Author's estimates.

Spring current-year and autumn one-year-ahead projections outperform an extrapolation of growth

39. The comparison of R^2-values in Table 3 has already touched upon the quality of the EO relative to alternative projections. $R^2=0$ means that the sample mean of realisations does as well as the EO in projecting GDP growth, whereas $R^2<0$ implies that the mean of realisations outperforms EO projections as a predictor. As mentioned before, using the sample mean of realisations is no viable forecasting rule, however, since the forecaster does not know the sample mean at the time of projection. At best, the forecaster could use the historical mean, *i.e.* the mean of realisations up to the day of the projection (see Tulip, 2005). However, alternative forecasts are available that a valuable projection should improve upon. Candidates for comparison are model-based or expert forecasts from other institutions and naïve rule-of-thumb projections, such as the extrapolation of previous rates of GDP growth.

[22] One could even go further and say that serial correlation in news should itself be incorporated in the forecaster's information set, so that revisions should be generally uncorrelated.

40. Naïve forecasts are a simple, but important benchmark. They are easily available and, contrary to more elaborate projections, involve little or no cost. Usually, comparison with naïve forecasts relies on the Theil statistic (see Carnot *et al.*, 2005; Fildes and Stekler, 2002; Koutsogeorgopoulou, 2000). Alternatively, Vuchelen and Gutierrez (2005a, b) propose a regression that tests the information content of projections. The test regresses realisations of growth on a constant, past realisations and the projections. For current-year projections the regression equation is

$$X_t = \alpha + \beta X_{t-1} + \gamma\left(P_t^t - X_{t-1}\right) + \varepsilon_t . \qquad (7)$$

X_t is the realisation and P_t^t-X_{t-1} the deviation of the projection from the previous realisation.[23] Forecasts are valuable if γ is significantly positive. Otherwise they do not add valuable information to a simple extrapolation of past values. Finding that $\beta=\gamma=0$ implies that constant growth at rate α is a better predictor of future growth. Two additional hypotheses are tested: $\alpha=0$, $\beta=\gamma=1$, implying $X_t=P_t^t$, *i.e.* efficiency of EO projections, and $\beta=\gamma$, in which case $X_t= \alpha + \gamma P_t^t$, *i.e.* the EO projection encompasses the information in previous growth, but is not necessarily efficient. For one-year-ahead projections, consider the regression

$$X_{t+1} = \alpha + \beta X_{t-1} + \gamma\left(P_t^t - X_{t-1}\right) + \delta\left(P_t^{t+1} - P_t^t\right) + \varepsilon_t , \qquad (8)$$

with P_t^{t+1}-P_t^t as the difference between one-year-ahead and current-year projections made at the same time. If δ is significantly positive, one-year-ahead projections provide additional information.[24]

41. Table 9 reports the estimates of equations (7) and (8) for G7 countries over the period 1991-2006. The results indicate that current-year projections have strong information content, in line with the high R^2 in Table 3. Column 1 does not reject the hypothesis that current-year projections in the spring EO are efficient and encompass the information from an extrapolation of previous growth rates, *i.e.* $\alpha=0$ and $\beta=\gamma=1$. Spring EO forecasts thus outperform an extrapolation of the previous growth rates as a predictor of current growth. The good performance of current-year projections to some extent reflects the fact that carry-over effects make a substantial part of the information on current-year growth already available by spring.

[23] Equations (7) and (8) are extensions of (2). They decompose the forecast into a naïve projection, *i.e.* past growth, and a component of expert judgement, *i.e.* the difference between the EO projections and the naïve projection.

[24] The growth rate published in the autumn EO is considered as the lagged realisation value for autumn one-year-ahead projections in regression (8). This number is the most accurate value for past realisations that is available at the time of the projection. Realisations as reported in the spring EO remain our dependent variable though.

Table 9: The information content of EO projections

EO projection	Spring current year	Autumn one year ahead	Spring one year ahead
α	0.02 (0.09)	0.11 (0.22)	2.09 (0.25)***
β	0.96 (0.04)***	0.81 (0.11)***	-0.02 (0.10)
γ	1.04 (0.00)***	0.79 (0.05)***	0.13 (0.15)
δ	-	0.92 (0.12)***	-0.17 (0.10)*
F (α=0, β=γ=δ=1)	0.14	0.00***	0.00***
F (β=γ=δ)	0.05**	0.54	0.06*
Country dummies (p-value)	0.83	0.28	0.03**
Country dummies	No	No	Yes
R^2	0.75	0.28	0.20
Durbin-Watson statistic	2.02	1.87	1.72
Box-Ljung AR 1 (p-value)	0.95	0.52	0.74
Box-Ljung AR 2 (p-value)	0.46	0.79	0.70
Jarque-Bera (p-value)	0.44	0.19	0.00***
Number of observations	112	112	112

*, ** and *** denote significance at the 10%, 5% and 1% levels respectively. Robust standard errors reported in parentheses.
Source: Author's estimates.

42. As regards autumn EO one-year-ahead projections (column 2), the previous realisation, the deviation of current-year projections from lagged growth, and the difference between one-year-ahead and current-year projections are all positive and highly significant. The hypothesis of forecast efficiency (α=0, β=γ=δ=1) is rejected at this projection horizon, but the hypothesis that one-year-ahead projections encompass the information in both current-year projections and lagged GDP growth (β=γ=δ) is accepted. Consequently, autumn one-year-ahead projections, though not efficient, provide valuable information, which confirms the earlier result in Table 4.

43. Column 3 for spring EO one-year-ahead projections reports insignificant coefficients for lagged GDP growth and the deviation of current-year projections from previous growth rates. It also reports a negative value for δ. The latter would imply that deviations of one-year-ahead from current-year projections in the spring EO are not only without value, but even misleading.[25] Column 3 supports the conclusion from Tables 3 and 4, *i.e.* that individual country means are a better (*ex post*) predictor of GDP growth than spring EO one-year-ahead projections.

Outlook projections for the current year encompass the Consensus forecast

44. Alternative expert forecasts constitute another benchmark for the EO projections. Table 3 has already provided a comparison of R^2 between EO and CE. Figures A.1 to A.3 plot the respective projection profiles across countries and over time and suggest a similar performance of EO and CE projections. Tables 3, 6 and A.3 indicate that spring EO projections for the current year are more accurate, on average, and spring EO one-year-ahead projections more misleading than their CE counterparts.

[25] The negative δ estimate becomes insignificant, however, when applying the version of the White estimator that accommodates cross-sectional heteroskedasticity.

45. Equations (9) and (10) submit this inference to another regression test. The framework draws on the comparison of EO projections with past realisation in (7) and (8) and considers CE projections, instead of previous growth rates, as the alternative predictor

$$X_t = \alpha + \beta P_t^{CE} + \gamma\left(P_t^{EO} - P_t^{CE}\right) + \varepsilon_t . \qquad (8)$$

X_t is the realisation, P_t^{CE} the Consensus forecast and P_t^{EO}-P_t^{CE} the difference between EO and Consensus projections. The CE forecast contains information if β significantly positive. If γ is significantly positive, the EO projections add information to the CE. Finally, EO projections encompass the CE forecast if β=γ.

46. The estimates in column 1 of Table 10 suggest that spring EO current-year projection are an efficient predictor of current-year GDP growth that encompasses the CE forecast. Under the maintained hypothesis β=γ=1, equation (8) simplifies to equation (4). The finding of efficiency of EO current-year projections confirms the result in Table 4, and the finding of the EO projection encompassing the CE forecast matches the current-year estimates in Table 6 and A.3. The superior performance of EO current-year projections potentially originates from the informational advantage implicit in the timing of EO and CE projections.[26]

Table 10: The information content of EO versus CE projections

EO projection	Spring current year	Autumn one year ahead	Spring one year ahead
α	-0.04 (0.09)	0.06 (0.20)	1.75 (0.40)***
β	0.99 (0.04)***	0.86 (0.08)***	0.07 (0.15)
γ	0.95 (0.15)***	0.47 (0.43)	0.15 (0.40)
F (α=0, β=1, γ=1)	0.40	0.00***	0.00***
F (β=γ)	0.76	0.39	0.83
Country dummies (p-value)	0.85	0.24	0.03**
Country dummies	No	No	Yes
R^2	0.75	0.27	0.16
Durbin-Watson statistic	2.15	1.92	1.43
Box-Ljung AR 1 (p-value)	0.56	0.78	0.07*
Box-Ljung AR 2 (p-value)	0.24	0.88	0.07*
Jarque-Bera (p-value)	0.49	0.20	0.00***
Number of observations	112	112	112

*, ** and *** denote significance at the 10%, 5% and 1% levels respectively. Robust standard errors reported in parentheses.
Source: Author's estimates.

47. The insignificance of γ in column 2 implies that autumn EO one-year-ahead projections do not add significant value to the respective Consensus, which confirms the insignificance of β in Tables 6 and A.3. In line with Table 3, column 3 shows that both spring EO and CE projections are poor predictors and again suggests country-specific sample means as better (*ex post*) predictors of GDP growth at this forecast horizon.

The directional accuracy of Outlook projections is high

48. The directional accuracy is another informative criterion: good forecasts should go in the right direction. Low directional accuracy typically implies larger errors, but directional accuracy of GDP growth projections may also have value of its own. Table 11 presents projected and realised pick-ups and slowdowns in GDP growth. Pick-ups are observations with an increase in the growth rate compared to the

[26] See footnote 6.

previous year. Correspondingly, slowdowns refer to a growth-rate decline or stagnation. The sample almost balances pick-ups (55 observations) and slowdowns (57).

Table 11: Directional accuracy of EO projections

A. Spring current year

Outcome	Projection		Sub-total
	ΔP(X)>0	ΔP(X)≤0	
ΔX>0	50	5	55
ΔX≤0	11	46	57
Sub-total	61	51	112

B. Autumn one year ahead

Outcome	Projection		Sub-total
	ΔP(X)>0	ΔP(X)≤0	
ΔX>0	45	10	55
ΔX≤0	19	38	57
Sub-total	64	48	112

C. Spring one year ahead

Outcome	Projection		Sub-total
	ΔP(X)>0	ΔP(X)≤0	
ΔX>0	47	8	55
ΔX≤0	34	23	57
Sub-total	81	31	112

Source: OECD Economic Outlook database, own calculations.

49. The percentage of directionally accurate in total projections is a simple measure of directional accuracy. The numbers indicate that 86% of spring EO current-year projections are directionally accurate. Autumn and spring one-year-ahead projections correctly anticipate 74% and 65% of the growth pick-ups and slowdowns, respectively.

50. Additionally, a χ^2 independence test can be used to assess whether projections and realisations move in the same direction (see Carnot *et al*., 2005). The null hypothesis is that projections and realisations are independent from each other. The statistic follows a χ^2 distribution with one degree of freedom. The values for spring EO current-year, spring EO one-year-ahead and autumn EO one-year-ahead projections -- 65.7, 9.31 and 26.9, respectively -- all reject the null of independence at the 1% level. Hence, the EO projections can be considered directionally accurate.

Current-year projections get most turning points right, but one-year-ahead projections generally fail

51. An alternative to looking at growth pick-ups and slowdowns is to look at changes in sign of GDP growth rates. Arguably, anticipating turning points is a major challenge for forecasters. The correct projection of turning points provides policy-makers with important information, which naïve alternatives could hardly generate. For instance, an extrapolation of GDP growth lagged once would never suggest a turning point in the series.

52. Table 12 compares observed and predicted turning points for the three forecast horizons. Turning points are defined as changes from positive to negative growth rates, *i.e.* recessions, or vice versa, *i.e.* recoveries. The table limits itself to sizable changes in the cycle. Only recessions and recoveries that

also imply a change in growth rates, in absolute terms, of at least 0.5 percentage point compared to the previous year qualify as turning points. The threshold value accounts for the fact that small changes in reported growth could vanish as the national accounts get revised in subsequent months and years.[27]

Table 12: Prediction of turning points

Turning points	Spring current year	Autumn one year ahead	Spring one year ahead
Observed turning points	17	17	17
Turning points to total observations	0.16	0.16	0.16
EO predicted turning points	18	2	2
Number of correct EO predictions	13	1	1
Share of correct EO predictions	76%	6%	6%
Share of correct CE predictions	53%	12%	0%

Source: OECD Economic Outlook database, own calculations.

53. Table 12 indicates that once recessions or recoveries are under way, spring EO current-year projections correctly anticipate, or notice, three fourths of the turning points. The EO outperforms CE forecasts on this account. By contrast, the percentage share of correct anticipations of turning points one year ahead is extremely low.

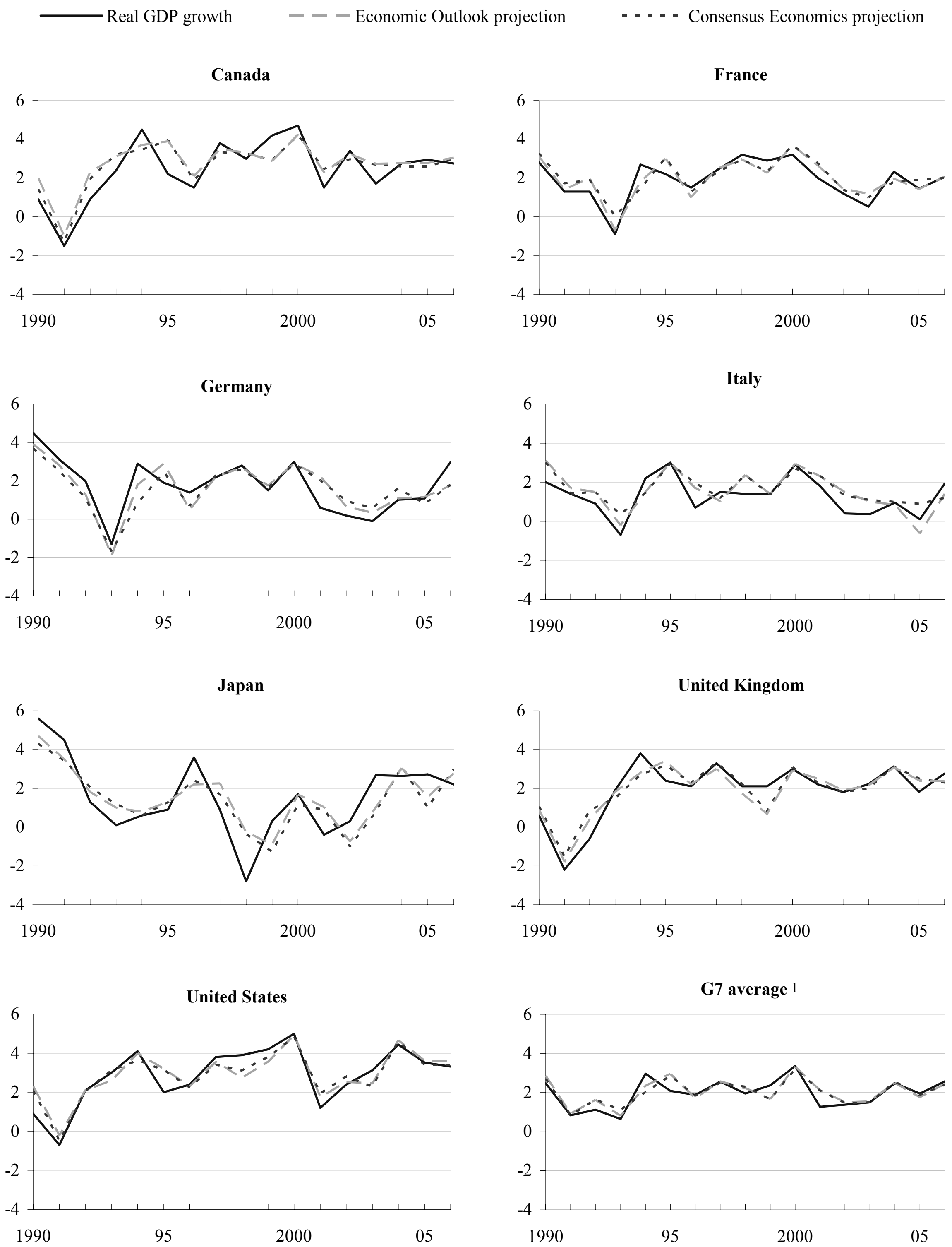
4. Conclusions

54. To sum up, the OECD growth projections for the G7 countries published in the *Economic Outlook* since the early 1990s display a number of desirable features. First, projections for the current year are unbiased and efficient. Second, projection errors do tend to shrink as the horizon shortens. Third, projections are directionally accurate most of the time. Even so, the OECD growth projections also suffer from some shortcomings. In particular, one-year-ahead projections display a positive bias, predominantly reflecting the overestimation during slowdowns. Spring one-year-ahead projections are far less informative than autumn ones, and turning points are poorly anticipated one year ahead. However, such drawbacks are also attached to other forecasts, including those produced by Consensus Economics or the IMF (Glueck and Schleicher, 2005; Timmermann, 2006). Regression analysis suggests that both OECD projections and Consensus Economics forecasts add value to naïve forecasts for spring current-year and autumn one-year-ahead projections. EO projections for the current year encompass the information value of the Consensus.

55. Areas for further exploration include forecasting performance with regard to other key macroeconomic variables such as inflation or fiscal positions. Additionally, it might be interesting to consider forecasting accuracy for small open economies, where volatility in the underlying realisation is typically higher. From a comparative perspective, forecasts with a scenario for the global economy may perform particularly well for countries that strongly depend on external factors.

[27] The average absolute revision of GDP growth data between first and latest releases equals 0.44 percentage points for G7 countries in the period 1996-2000 (Ahmad *et al.*, 2004). In this light, a threshold value for turning points of 0.5 percentage point of GDP growth seems reasonable.

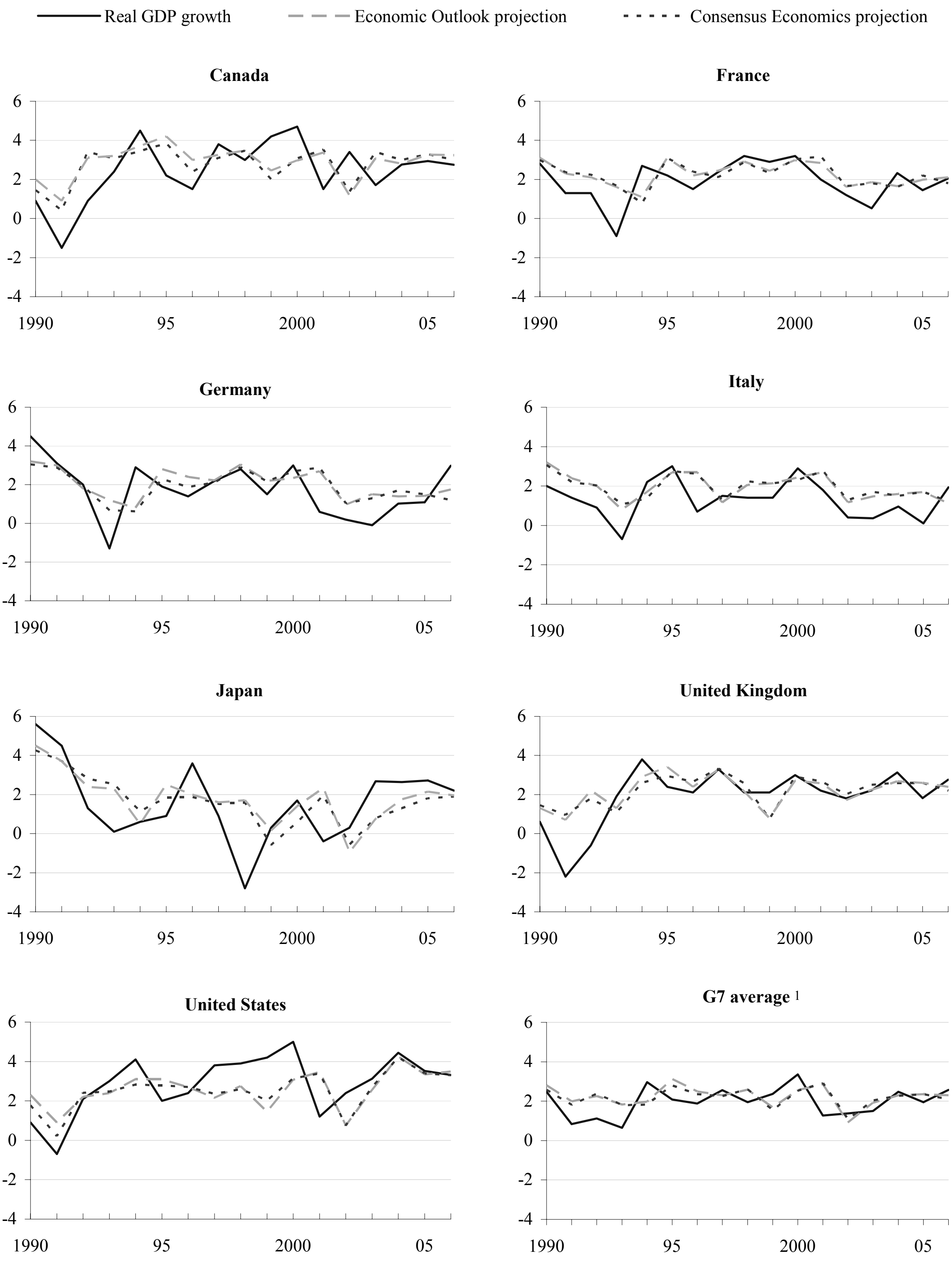
Figure A.1: GDP growth and spring current-year projections



1. Unweighted average of G7 countries.

Source: Consensus Economics, OECD Economic Outlook database.

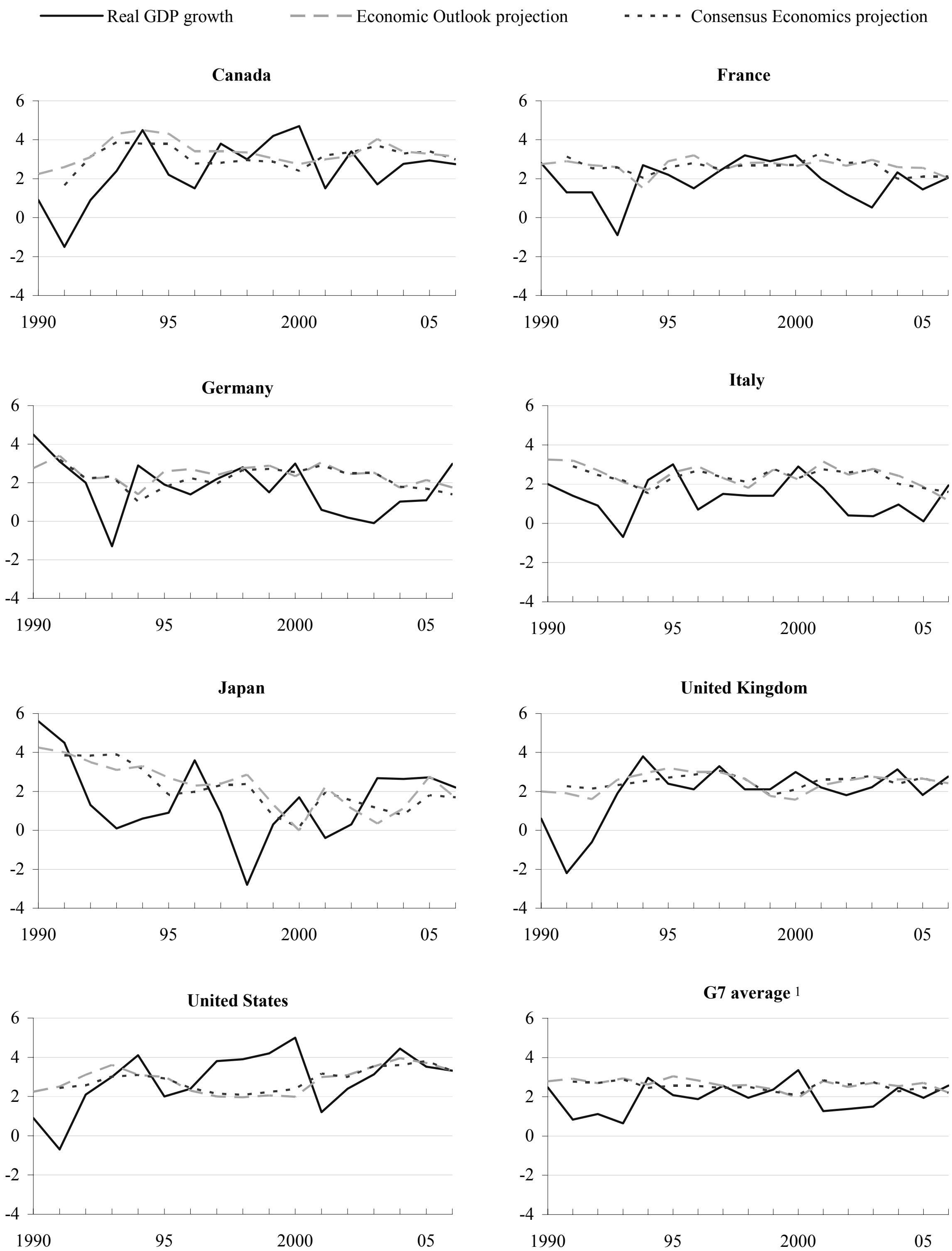
Figure A.2: GDP growth and autumn one-year-ahead projections



1. Unweighted average of G7 countries.

Source: Consensus Economics, OECD Economic Outlook database.

Figure A.3: GDP growth and spring one-year-ahead projections

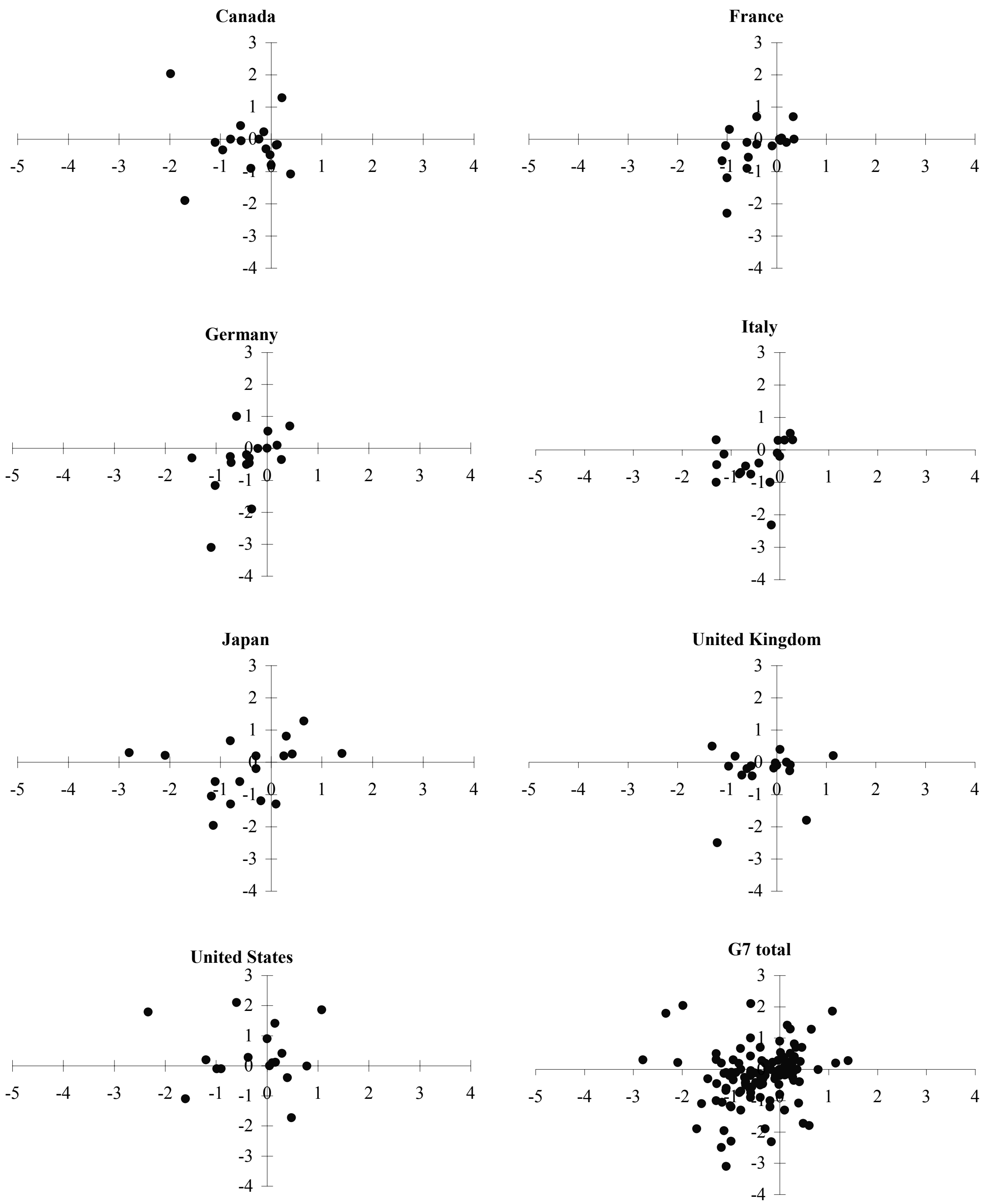


1. Unweighted average of G7 countries.
Source: Consensus Economics, OECD Economic Outlook database.

Figure A.4: Are consecutive revisions of EO projections correlated?

X-axis: Revision in autumn t-1 of spring t-1 projections for year t

Y-axis: Revision in spring t of autumn t-1 projections for year t



Source: OECD Economic Outlook database, own calculations.

Table A.1: Cross-country correlation of EO projection errors 1991-2006

Spring current-year projection

	United States	United Kingdom	Japan	Italy	Germany	France	Canada
Canada	0.4	0.8	0.2	0.4	0.2	0.7	1.0
France	0.4	0.7	0.1	0.3	0.5	1.0	
Germany	0.3	0.3	0.1	0.2	1.0		
Italy	0.3	0.2	0.0	1.0			
Japan	0.0	0.1	1.0				
United Kingdom	-0.1	1.0					
United States	1.0						

Autumn one-year-ahead projection

	United States	United Kingdom	Japan	Italy	Germany	France	Canada
Canada	0.9	0.7	0.2	0.4	0.3	0.6	1.0
France	0.4	0.4	0.1	0.5	0.8	1.0	
Germany	0.2	0.0	0.2	0.6	1.0		
Italy	0.2	0.3	-0.1	1.0			
Japan	-0.3	0.0	1.0				
United Kingdom	0.1	1.0					
United States	1.0						

Spring one-year-ahead projection

	United States	United Kingdom	Japan	Italy	Germany	France	Canada
Canada	0.9	0.8	0.0	0.5	0.3	0.7	1.0
France	0.6	0.6	-0.2	0.8	0.8	1.0	
Germany	0.4	0.2	0.0	0.8	1.0		
Italy	0.1	0.5	-0.1	1.0			
Japan	0.1	0.5	1.0				
United Kingdom	-0.2	1.0					
United States	1.0						

Source: OECD Economic Outlook database, own calculations.

Table A.2: Testing for asymmetry in the persistence of projection errors

EO projection	**Spring current year**	**Autumn one year ahead**	**Spring one year ahead**
α	0.07 (0.05)	0.30 (0.16)*	0.62 (0.20)***
β	-0.06 (0.12)	-0.06 (-0.36)	0.04 (0.16)
γ	0.11 (0.17)	0.22 (0.78)	0.57 (0.24)**
Country dummies (p-value)	0.85	0.42	0.62
Country dummies	No	No	No
R^2	0.00	0.01	0.13
Durbin-Watson statistic	2.14	2.10	2.02
Box-Ljung AR 1 (p-value)	0.60	0.67	0.84
Box-Ljung AR 2 (p-value)	0.30	0.90	0.98
Jarque-Bera (p-value)	0.55	0.42	0.84
Number of observations	112	112	112

*, ** and *** denote significance at the 10%, 5% and 1% levels respectively. Robust standard errors reported in parentheses. The estimated equation is $E_t=\alpha+\beta E_{t-1}+\gamma D_s E_{t-1}+\varepsilon_t$. D_s is a dummy variable equal to one during growth slowdowns and zero otherwise.
Source: Author's estimates.

Table A.3: Regressing CE projection errors on forecasts differentials

EO projection	Spring current year	Autumn one year ahead	Spring one year ahead
α	0.07 (0.04)	0.26 (0.13)**	0.62 (0.15)***
β	0.95 (0.15)***	0.58 (0.44)	0.30 (0.36)
Country dummies (p-value)	0.88	0.46	0.45
Country dummies	No	No	No
R^2	0.13	0.02	0.00
Durbin-Watson statistic	2.16	2.05	1.51
Box-Ljung AR 1 (p-value)	0.52	0.79	0.03**
Box-Ljung AR 2 (p-value)	0.24	0.85	0.09*
Jarque-Bera (p-value)	0.56	0.42	0.29
Number of observations	112	112	112

*, ** and *** denote significance at the 10%, 5% and 1% levels respectively. Robust standard errors reported in parentheses.
Source: Author's estimates.

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