Journal of Macroeconomics 45 (2015) 186–201

Contents lists available at ScienceDirect

Journal of Macroeconomics

journal homepage: www.elsevier.com/locate/jmacro

Cross-country evidence on the quality of private sector fiscal forecasts

João Tovar Jalles [a,*], Iskander Karibzhanov [b], Prakash Loungani [c,1]

[a] International Monetary Fund, Fiscal Affairs Department, 700 19th Street NW, Washington, DC 20431, USA
[b] Bank of Canada, International Economic Analysis Department, 234, Laurier Avenue West, Ottawa, Ontario K1A 0G9, Canada
[c] International Monetary Fund, Research Department, 700 19th Street NW, Washington, DC 20431, USA

ARTICLE INFO

Article history:
Received 12 July 2014
Accepted 24 April 2015
Available online 19 May 2015

JEL classification:
C53
E27
E37
E62
D8

Keywords:
Bias
Efficiency
Forecast comparison
Business cycles
Recession
Recovery

ABSTRACT

This paper provides evidence of the quality of private sector forecasts of the budget balance between 1993 and 2009 for a sample of 29 countries, grouped into advanced and emerging countries. We find large differences across the two groups: forecasts for advanced economies are much more accurate than for emerging economies and much less subject to a bias towards optimism (i.e. they are less likely to forecast a bigger budget balance than the realization). Forecasts for both groups, however, exhibit a tendency toward forecast smoothing: forecasts are revised slowly so that revisions to forecasts can be systematically predicted based on past revisions. This tendency proves costly around turning points in the economy when the budget balance moves sharply but the corresponding forecasts only adjust very slowly to the reality of the situation.

1. Introduction

Government forecasts of budget deficits invoke considerable skepticism. A prominent critic is Frankel (2012) who mocks the "budgetary wishful thinking" of many government agencies. He notes that during the 2000s, the U.S. Office of Management and Budget "turned out optimistic forecasts" for eight years in a row; likewise, in 2000, the Greek government projected that its budget deficits would shrink below 2 percent of GDP within a year, a far cry from the outcome of 4–5 percent of GDP. Such examples have tended to be the rule rather than the exception: Frankel (2011) analyzes official government forecasts of 33 countries and finds a positive bias on average; that is, the fiscal balance turns out to be lower than initially forecast. Many earlier studies in the literature have also pointed out the deficiencies of government budget forecasts.[2]

* Corresponding author. Tel.: +1 202 623 8689.
E-mail addresses: jjalles@imf.org (J.T. Jalles), kais@bankofcanada.ca (I. Karibzhanov), ploungani@imf.org (P. Loungani).
[1] Tel.: +1 202 623 7043.

[2] See Leal et al. (2008, p. 350) for a discussion of previous studies, which include Strauch et al. (2004), Moulin and Wierts (2006), Annett (2006), Jonung and Larch (2006), and Pina and Venes (2011).

http://dx.doi.org/10.1016/j.jmacro.2015.04.009
0164-0704/

The findings of bias have led to demands that fiscal forecasts should be produced by stronger national fiscal institutions or independent agencies. Frankel and Schreger (2013) show that the tendency of Eurozone governments to be over-optimistic—particularly when their budget deficit is over the 3% of GDP ceiling placed by the Stability and Growth Pact—is curbed in countries that have created an independent fiscal institution to provide forecasts. Another suggestion to curb bias is that government forecasts should be supplemented by private sector forecasts, which are presumably less subject to the political pressures that governments face. Frankel and Schreger (2014) find that private sector forecasts exhibit less bias than government forecasts.[3]

This paper contributes to the fledgling literature on the assessment of private sector fiscal forecasts. We provide systematic evidence on the quality of budget balance forecasts for 29 countries over the 1993–2009 time period. The countries are grouped into 9 advanced economies and 20 emerging economies. The source of the data is the publication *Consensus Forecasts*. Each month, the publication provides forecasts of several macroeconomic variables, including the annual budget balance for the current year and the year ahead. Hence, for each year there are a sequence of 24 forecasts, the first twelve made during the previous year—referred to as year-ahead forecasts—and the next twelve made during the target year, called current-year forecasts. We use this sequence of forecasts to conduct standard tests of forecast assessment, as in Artis and Marcellino (2001), as well as the more recent tests of information rigidities discussed in Coibion and Gorodnichenko (2012) and Coibion (2015).

Our main findings are twofold. First, we find there are significant differences between the two groups of countries in the quality of private sector forecasts. The forecasts for advanced economies display less bias and are more accurate than those for emerging markets. Second, for both groups of countries, there is evidence of 'information rigidities'—this is a term used by Coibion and Gorodnichenko (2012) to describe the tendency to smooth forecasts in a way that is inconsistent with full information rational expectations.

We discuss each of these findings in turn. First, on bias and accuracy, we find a big difference between advanced and emerging economies.

- *Bias*: For both groups there is a bias toward optimism—the forecasted balance is higher than the outcome—but for advanced economies this bias dissipates for the current-year forecasts. For example, for advanced economies the budget balance-to-GDP forecasts made in April of the previous year are more optimistic than the outcome by about 0.4 percentage points; but by October of the current year forecasts are slightly pessimistic, by about 0.1 percentage points. In contrast, for emerging markets the forecasts made in April of the previous year are too optimistic by 0.8 percentage points and those made in October of the current year remain too optimistic by 0.6 percentage points.
- *Accuracy*: For both groups, year-ahead forecasts are not very accurate: the mean absolute error for advanced economies is 1.3 percentage points and 2.4 percentage points for emerging markets. As would be expected, accuracy improves for both groups for current year forecasts but much less so for emerging markets—the mean absolute error drops to 0.7 percentage points for advanced economies and only to 1.8 percentage points for emerging markets.

How significant are these findings in an economic sense and are they consistent with findings on forecast errors for other macroeconomic variables? To assess the economic significance, note that for both groups the average budget balance-to-GDP ratio over this period is about -2 percentage points and the standard deviation of this ratio is about 3 percentage points. The bias in year-ahead forecasts is thus 20% and 40% of the mean (absolute) value of the variable for advanced and emerging economies, respectively; for emerging economies, the bias remains at 30% of the mean value even for current-year forecasts. The mean absolute error of year-ahead forecasts is 65% and 120% of the mean value, respectively, for the two groups. For both groups, current-year forecast errors remain large in size relative to the mean and standard deviation of the variable being forecast. Hence the results are not only of statistical significance, as shown later in the paper, but of substantial economic (or quantitative) significance. Moreover, the magnitude of the private sector forecast errors for advanced economies is similar to those found by Artis and Marcellino (2001) for official sector forecasts by international organizations.

Our finding of differences in the extent of bias across advanced and emerging economies is consistent with what has been found for other variables. A recent study of growth forecasts finds that "the tendency toward optimism is less for advanced economies than for emerging markets" (Ho and Mauro, 2014), echoing earlier findings in the literature (see Artis (1988, 1996), for example). To our knowledge, while many studies caution about poorer data quality and hence less accurate forecasts for emerging economies, reasons differences in accuracy of forecasts between the two groups of countries have not been systematically explored. Some papers find that forecast errors for real GDP growth are larger for emerging markets than for advanced economies (see Loungani et al., 2013; Dovern et al., 2015). These papers also find that, as with the fiscal forecasts studied in this paper, the improvement in accuracy is much less in emerging markets than in advanced economies as the forecasting horizon draws to a close. Dovern et al. (2015) suggest that "uncertainty about the actual data just before the end of the forecasting horizon is substantially higher in emerging economies than in advanced economies, possibly owing to lags in statistical data collection and the poor quality of initial data releases."

[3] See Debrun et al. (2009) for a survey of the literature on the performance of independent fiscal agencies. Milesi-Ferretti and Maria (2004) studies the scope that governments have for creative accounting when faced with budget rules. Poplawski-Ribeiro and Rulke (2011) examine whether the adoption of the Stability and Growth Pact led to a convergence of private, national and EC forecasts.

When it comes to fiscal forecasts there may be additional reasons for differences in accuracy, viz. the extent to which fiscal rules and other institutions constrain the government forecasts on which private forecasters may be dependent. Muhleisen et al. (2005) find that, even among a group of advanced countries, governments with fiscal rules and strong budgetary institutions provide more accurate forecasts. Though fiscal rules are being increasingly adopted in emerging markets as well, the literature suggest that thus far they are less effective in binding governments and in anchoring fiscal forecasts than in advanced economies (see IMF, 2009).

Turning to our second finding about rigidity in forecast revisions, Nordhaus (1987) demonstrated that an implication of rational expectations was that successive revisions of forecasts of the same event should be uncorrelated. If this was not the case, revisions would have a predictable component, which in turn would mean that forecasts were not using all available information. Nordhaus found that in practice forecasts deviated from rational expectations: forecast revisions tended to be positively correlated. In an influential revival of this line of work, Coibion and Gorodnichenko (2012) show that revisions to inflation forecasts contain a large predictable component, which provides evidence in favor of models that emphasize that "the frictions and limitations faced by agents in the acquisition and processing of information."

We find that revisions to fiscal forecasts also tend to be smooth. In economic terms, the estimated degree of information rigidity implies that it takes between 3 and 4 months for information to be fully reflected in forecasts. This is similar to estimates of rigidity in forecasts of real GDP growth estimated by Loungani et al. (2013). For inflation, Coibion and Gorodnichenko (2012) report faster updating of forecasts, between 1½ and 2 months.

As noted by Coibion (2015) and as we discuss later in the paper, our test of information rigidities is based on "a simpler and more tractable framework for quantifying information rigidities" than the approach in Coibion and Gorodnichenko (2012). The smoothing of forecasts proves to be particularly costly around turning points in the economy. Loungani (2001) and Ahir et al., (2015) show that most recessions are not predicted ahead of time by the private sector. As a consequence of these large errors in forecasting output around turning points, the fiscal forecasts around turning points also turn out to be way off the mark. Moreover, because forecasts are revised slowly, large errors end up being made over the course of recession years when there are large declines in the fiscal balance but forecasts only slowly catch up with this reality.

The remainder of the paper is organized as follows. Section 2 describes our data. In Section 3 we present results on the accuracy and bias in forecasts and on the extent of information rigidities. Section 4 discusses the sources of errors in fiscal forecasts and the behavior and performance of these forecasts around business cycle turning points. Section 5 has concluding remarks.

2. Data and summary statistics

Each month since 1989, the Consensus Economics service has published forecasts for major economic variables, initially for the G7 countries but subsequently for a large number of economies. For each country, the number of forecasters varies between about 10 and 30, and most forecasters are from the private sector. The bulk of our analysis is focused on the arithmetic mean of the forecasts, which is generally referred to as the 'consensus'. For some of the analysis we also used the standard deviation (the 'dispersion') of the forecasts.

We use forecasts of real output growth, inflation, and budget balance for the current and next year for the period from February 1993 to September 2009. Twenty nine countries are represented in the sample, of which we classify nine as 'advanced' economies (the G7 countries plus Australia and New Zealand) and remainder as 'emerging' economies. The sample is geographically diverse, covering countries in Asia, Europe and Western Hemisphere.[4]

The event being forecasted is the average budget balance-to-GDP ratio for a given target year.[5] For each target year, the sequence of forecasts is the 24 forecasts made between January of the previous year and December of the year in question. So, for example, the first forecast for the average budget balance-to-GDP ratio for 2009 is made in January 2008 and the last one in December 2009. We index the sequence of forecasts by the horizon (h), with $h = 24$ corresponding to the first forecast made and $h = 1$ corresponding to the last. As noted earlier, we also distinguish between year-ahead forecasts ($h = 13$–24) and current-year forecasts ($h = 1$–12).[6]

In addition to consensus forecasts, the dataset includes outcomes on real GDP growth, inflation and budget balance-to-GDP ratio from the IMF's International Financial Statistics and other sources. Recession episodes are taken from Loungani et al. (2013) and crises dates from Laeven and Valencia (2008).

Fig. 1 shows the distribution of the government's budget balance-to-GDP ratios for advanced and emerging countries over the full sample period, a presentation similar to that in Leal et al. (2008). The distribution is shown for four different

[4] Countries in the dataset: *Advanced:* USA, Japan, Germany, France, UK, Italy, Canada, Australia, New Zealand; *Emerging:* China, Hong Kong SAR, India, Taiwan POC, Czech Republic, Hungary, Poland, Russia, Turkey, Bulgaria, Croatia, Estonia, Latvia, Lithuania, Slovenia, Argentina, Brazil, Chile, Mexico, Venezuela. Selected results for individual G-7 countries are in an unpublished Appendix A available from the authors.

[5] Consensus Economics provides forecasts for the public sector budget balance in absolute numbers (local currency). As most fiscal criteria and rules for budgetary discipline are formulated in terms of the balance-to-GDP ratio, we construct these by using actual national GDP figures as the denominator. Alternatively, one could have followed Heppe-Falk and Hufner's (2004) approach: first, generate projected nominal GDP series (using information from Consensus' real GDP growth and inflation forecasts) and then take the respective ratio. In practice, the method of scaling is unlikely to make a big difference because much of the variation in the ratio comes from the numerator (the budget balance) rather than the denominator (level of GDP). As a robustness check, we used the latter method for a few countries; the correlation with the series based on our method exceeded 0.95 in all cases.

[6] For countries for which only bi-monthly forecasts are available, we use the preceding month forecast as values for the months for which forecast data is missing. We have confirmed that this does not qualitatively alter our results.

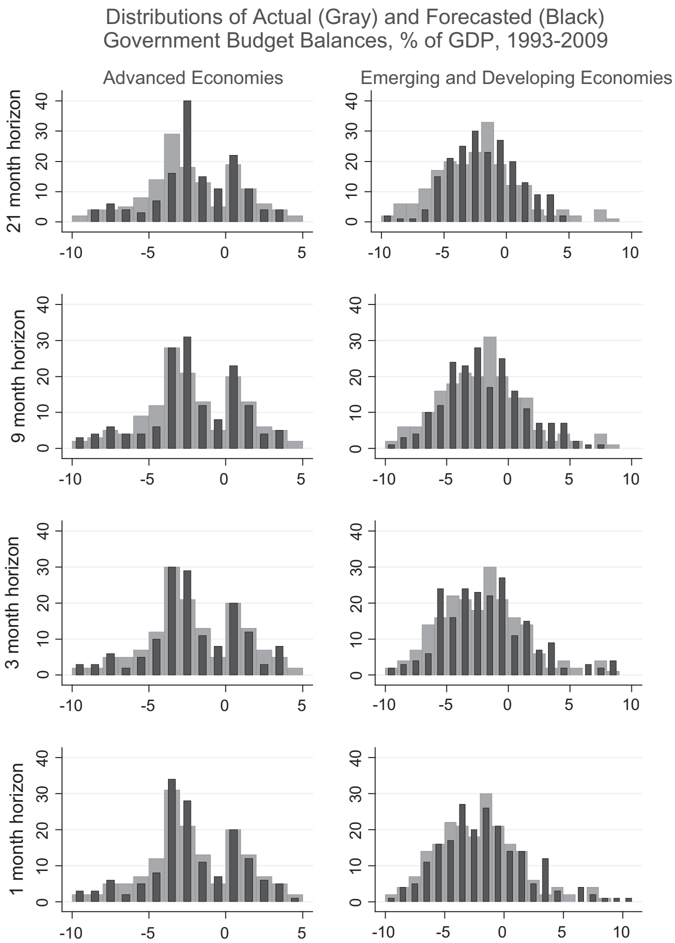

Fig. 1. Distributions of actual and forecasted budget balances (% GDP): consensus 1993–2009.

horizons, $h = 21$, 9, 3, and 1. For advanced economies, the distribution for $h = 21$ is centered between a deficit of between 2 and 3 percent of GDP; the distribution for emerging markets is more spread out. Of course, as the horizon draws to a close, the distributions of forecasts tend to converges to the distributions of actual values. But the convergence is much closer in the case of advanced economies than emerging economies.

This feature becomes evident when we look at summary statistics on the forecast errors, defined as the difference between the outcomes and the forecasts. In our discussion below, we often characterize a positive value for the error as 'pessimism' about the budget balance and a negative value for the error as 'optimism'. As a first pass look at bias and accuracy, we report in Table 1 the mean error, the mean absolute error, and the root mean squared error. As the basis for assessing these errors, the mean and standard deviation of the budget balance outcomes are also shown at the bottom of the table. These summary statistics on the outcomes are quite similar for the two groups of countries: for both, the mean budget balance is about −2% and the standard deviation is about 3%.

Turning now to the forecast errors, there are sharp differences between the two groups. First, for advanced economies the bias toward 'optimism' is much smaller than for emerging economies (−0.15 vs. −0.62 for the full sample) and only arises in the case of year-ahead forecasts. Second, the forecasts are much less accurate for the emerging economies and the improvement in accuracy in going from year-ahead to current-year forecasts is smaller.

3. Quality of forecasts

3.1. Tests of bias and efficiency

To test for bias, we look at whether the mean forecast error is significantly different from zero. As Holden and Peel (1990) show, this is a necessary and sufficient test for bias. The forecast error is given by:

$$A_t - F_{th} = \alpha + \varepsilon_{th} \quad (1)$$

Table 1
Summary statistics on budget balance forecast errors.

Stat.	All	Advanced	Emerging
	Full sample		
ME	−0.41	−0.15	−0.62
MAE	1.61	1.01	2.08
RMSE	7.34	2.19	11.29
	1993–2001		
ME	−0.45	0.06	−1.06
MAE	1.49	0.89	2.22
RMSE	7.91	1.40	15.77
	2001–2009		
ME	−0.40	−0.31	−0.44
MAE	1.68	1.10	2.02
RMSE	7.03	2.81	9.54
	Full sample: Year Ahead		
ME	−0.54	−0.30	−0.73
MAE	1.93	1.33	2.38
RMSE	8.54	3.46	12.42
	Full sample: Current Year		
ME	−0.28	0.01	−0.50
MAE	1.28	0.68	1.75
RMSE	6.09	0.88	10.11
Outcomes			
Mean	−2.02	−2.18	−1.79
STD	3.21	3.03	3.31

Notes: This table presents some descriptive statistics for the entire sample of $N = 29$ countries and two sub-samples containing either advanced or emerging countries. For information on the composition of each sub-sample refer to the main text. ME, MAE and RMSE stand for the mean forecast error, the mean absolute forecast error and the mean square forecast error, respectively (for details see the main text). The mean and standard deviation of the 'actual' budget balance (i.e. the outcomes) are also provided.

where A_t is the actual value of the budget balance-to-GDP ratio for target year t, F_{th} is the forecast for that target year made at horizon h, ε_{th} is the corresponding forecast error, and as before $h = 1, 2, \ldots, 24$. Forecasts are unbiased if we cannot reject the null hypothesis that $\alpha = 0$. If the estimated coefficient is negative, forecasts are biased toward optimism.

Table 2 reports, for 2 different forecast horizons, $h = 21$ and $h = 3$, the estimates of α and the standard errors.[7] For the full sample, forecasts are optimistic for both horizons, the estimates are −0.7 and −0.3. However, this is largely a result of the bias in the forecasts for emerging markets. For advanced economies, current year forecasts provide no statistical evidence for bias; and even the bias in the year ahead forecasts arises during the latter time period (2001–2009) and not in the earlier one (1993–2001).

To test for efficiency, we regress actual observations on a constant plus the forecast:

$$A_t = \alpha' + \beta F_{th} + \varepsilon_{th} \tag{2}$$

where the variables are as defined earlier. Forecasts are efficient if we cannot reject the null hypothesis that $\alpha' = 0$ and $\beta = 1$.

Table 3 presents our results for four choices of the horizon ($h = 21, 15, 9, 3$). For the full sample, we can reject the null hypothesis of a zero constant and a slope coefficient of unity, as indicated by the F-statistics and associated p-values reported in the last row of each block of regressions. Again, the pattern is different for the two groups. For emerging markets, efficiency can be rejected for all four cases shown. In the case of advanced economies, the rejection occurs for $h = 21$ and $h = 3$; however, in the latter case the rejection seems to occur because of modest pessimism about the budget balance outcome rather than optimism.

We can delve a little deeper in the source of the inefficiency, as done by Barrionuevo (1996) and Pons (2000) for the case of official sector forecasts. Barrionuevo distinguishes between (i) co-movements between the deviation of the outcome of the forecast and the forecast itself (the β-test) and (ii) the co-movement between the deviation of the outcome of the forecast in the current period and that in the previous period (the ρ-test).

We estimate β by regressing the forecast error on the forecast and ρ by regressing the current-period forecast error on the previous period error:

$$\begin{aligned} e_t &= \alpha + \beta F_t + u_{1t} \\ e_t &= \gamma + \rho e_{t-1} + u_{2t} \end{aligned} \tag{3}$$

[7] We also computed the Ljung-Box Q-statistic for testing up to 3 lags possible serial correlation in the time series of the forecast errors (not shown).

Table 2
Bias.

Spec.	All-pooled (1)	Advanced (2)	Emerging (3)
Full sample			
Year Ahead April (t − 1)			
α	−0.65***	−0.41**	−0.82***
	(0.16)	(0.17)	(0.25)
Current Year October (t)			
α	−0.33**	0.13**	−0.60**
	(0.16)	(0.06)	(0.24)
1993–2001			
Year Ahead April (t − 1)			
α	−0.65**	0.15	−1.54***
	(0.29)	(0.20)	(0.53)
Current Year October (t)			
α	−0.35	0.14	−0.74
	(0.31)	(0.11)	(0.54)
2001–2009			
Year Ahead Apr.(t − 1)			
α	−0.51**	−0.73***	−0.39
	(0.20)	(0.27)	(0.28)
Current Year October (t)			
α	−0.26	0.18**	−0.45*
	(0.17)	(0.08)	(0.25)

Note: The dependent variable is Consensus forecast error. Each cell reports the results of a regression of forecast errors on a constant for the entire sample of $N = 29$ countries and two sub-samples containing either advanced or emerging countries. For information on the composition of each sub-sample refer to the main text. We consider the full time span and then also the 1993–2001 and 2001–2009 periods in separate. Heteroskedastic-consistent robust standard errors are reported in parenthesis.

* Significance at 10%.
** Significance at 5%.
*** Significance at 1%.

Table 3
Test of efficiency.

Country group / Model	Independent variables	Dependent variable: "actual" budget balance (%GDP) April (t − 1)	October (t − 1)	April (t)	October (t)
All	Constant	−1.16***	−0.86***	−0.81***	−0.81***
		(0.25)	(0.23)	(0.07)	(0.26)
	Forecast	0.74***	0.78***	0.68***	0.71***
		(0.07)	(0.07)	(0.23)	(0.08)
	F-statistic	10.73	7.01	4.45	6.19
	p-value	0.00	0.00	0.01	0.00
Advanced	Constant	−0.59**	−0.18	−0.05	0.17**
		(0.24)	(0.15)	(0.11)	(0.07)
	Forecast	0.92***	0.99***	1.00***	1.04***
		(0.06)	(0.04)	(0.03)	(0.02)
	F-statistic	3.23	0.84	0.17	3.00
	p-value	0.04	0.43	0.84	0.05
Emerging	Constant	−1.49***	−1.29***	−1.07***	−1.19***
		(0.36)	(0.35)	(0.36)	(0.34)
	Forecast	0.62***	0.64***	0.70***	0.62***
		(0.12)	(0.10)	(0.10)	(0.10)
	F-statistic	8.58	7.12	4.87	6.98
	p-value	0.00	0.00	0.01	0.00

Note: The regression is expressed as $A_t = \beta_0 + \beta_1 F_t + u_t$, where A is the actual realization and F is the forecast. The F-statistic and associated p-value are for the test of the null hypothesis that $\beta_0 = 0$ and $\beta_1 = 1$. Country fixed effects are included in each regression but not reported for reasons of parsimony. Heteroskedastic-consistent robust standard errors are reported in parenthesis.

* Significance at 10%.
** Significance at 5%.
*** Significance at 1%.

Table 4
Sources of inefficiency.

Spec.	All-pooled (1)	Advanced (2)	Emerging (3)
Full sample			
Current Year October (t)			
β	−0.18***	0.00	−0.29***
	(0.07)	(0.03)	(0.10)
ρ	0.67***	0.33***	0.70***
	(0.08)	(0.08)	(0.09)
Year Ahead April (t − 1)			
β	−0.25***	−0.08	−0.37***
	(0.07)	(0.06)	(0.12)
ρ	0.58***	0.40***	0.62***
	(0.06)	(0.09)	(0.07)
1993–2001			
Current Year October (t)			
β	−0.35**	0.03	−0.69***
	(0.15)	(0.04)	(0.23)
ρ	0.83***	0.38***	0.86***
	(0.17)	(0.11)	(0.19)
Year Ahead April (t − 1)			
β	−0.33**	−0.02	−0.51*
	(0.17)	(0.07)	(0.30)
ρ	0.78***	0.42***	0.79***
	(0.12)	(0.14)	(0.13)
2001–2009			
Current Year October(t)			
β	−0.12**	0.00	−0.18**
	(0.06)	(0.05)	(0.09)
ρ	0.58***	0.37***	0.60***
	(0.09)	(0.12)	(0.10)
Year Ahead April (t − 1)			
β	−0.22***	−0.09	−0.32***
	(0.08)	(0.09)	(0.12)
ρ	0.48***	0.35***	0.51***
	(0.06)	(0.11)	(0.06)

Note: β is the estimated coefficient from a least-squares regression of the forecast error on the forecast, as specified in Eq. (3) in the main text. ρ is the estimated coefficient from a least-squares regression of the current period forecast error in the forecast error of the previous period, as specified in Eq. (3) in the main text. Estimations are carried out for the entire sample of $N = 29$ countries and two sub-samples containing either advanced or emerging countries. For information on the composition of each sub-sample refer to the main text. Heteroskedastic-consistent robust standard errors are reported in parenthesis.
* Significance at 10%.
** Significance at 5%.
*** Significance at 1%.

where e and F denote forecast error and forecast, respectively.

A condition for efficiency is that the estimates of both β and ρ should be zero. If ρ is different from zero and β is zero, the forecast is "inefficient because the errors of the past are repeated in the present, and hence forecasts could be improved by adjusting them by ρ" (Pons, 2000). If ρ is zero and β is different from zero, the inefficiency arises because the model used to derive the forecast is not the minimum variance model. If β and ρ are both different from zero, "the inefficiency is partly due to the way in which new information is incorporated into projected values and partly because the present errors are highly correlated with past ones" (Pons, 2000).

Table 4 presents our results. For the full sample, we can see by looking down the first column that both β and ρ are different from zero. The next two columns show that, in the case of β, the rejection of efficiency occurs solely because of the emerging markets; for the advanced economies the estimates of β are all essentially zero. In the case of ρ, however, the rejection of efficiency is shared by both advanced and emerging economies; while the estimate of ρ is smaller in the case of advanced economies, it is always between 0.3 and 0.4 and significantly different from zero.

This suggests that in both advanced and emerging economies, the errors of the past are repeated in the present, a feature that comes through clearly when we look at the pattern of forecast revisions.

3.2. Tests of information rigidity

Nordhaus (1987) demonstrated that a property of rational forecasts is that successive revisions of forecasts of the same event are uncorrelated. If this was not the case then forecast revisions could be predicted on the basis of past revisions, which are clearly in the information set of the forecaster and also often available to external observers. In practice, Nordhaus found that revisions do tend to serially correlated, a departure from full information rational expectations.

Over the last decade, two main classes of theories have emerged to account for this departure. One theory, due to Mankiw and Reis (2002) and called 'sticky information', is there are fixed costs of acquiring and updating information, which leads infrequent updating of forecasts. The other, due to Woodford (2001) and Sims (2003) and called 'noisy information', states that forecasters continually update their information but, because they receive noisy signals about the underlying state, never get to the full information rational expectations solution.

In an influential paper, Coibion and Gorodnichenko (2012) show that both classes of theories of information rigidities imply that that the forecast error will be correlated with forecast revisions; the coefficient on the forecast revision is zero under the null of full informational rational expectations, whereas a positive value indicates information rigidities. One feature of this test is that it requires the use of the outcomes and hence requires a view on whether to use the latest version of the outcome or some earlier 'real-time' vintage.

We circumvent this difficult issue by using an equivalent test based on forecast revisions. Dovern et al. (2015) show that both classes of models of information rigidities described earlier imply that regressions of revisions of forecasts on the past revision should yield a positive coefficient; in contrast, the full information rational expectations model would predict that the coefficient is zero. As noted by Coibion (2015), this test has the advantage that "because it relies on forecast revisions rather than forecast errors, the econometrician does not have to take a stand on which version of the ex-post data to use to construct forecast errors (e.g. advance estimates vs. final estimates)." Moreover, the estimated regression coefficient conveniently "maps linearly into underlying degrees of information rigidity from each model (frequency of unchanged expectations in sticky information and weight on past beliefs in noisy information)."

To implement the test, we define the initial revision of the forecast as the change in the forecast between October and April of the previous year (i.e. between $h = 21$ and $h = 15$), the middle revision as the change between April of the current year and October of the previous year (between $h = 15$ and $h = 9$), and the final revision as the change between October of the current year and April of the current year (between $h = 9$ and $h = 3$).

Results from regressions of final revisions on earlier ones are shown in Table 5. In all six regressions, there is evidence of a strong positive correlation among forecast revisions. Efficiency can be rejected for both industrialized and emerging countries, particularly in cases where the revisions are adjacent; that is, when final revisions are regressed on middle revisions. Regressions of final revisions on initial revision also yield a positive coefficient but the magnitude is small. Overall, there is a clear tendency for "forecast smoothing".

In Table 6 we show how the extent of forecast smoothing changes with the onset of a recession. We augment the regressions of final revisions on middle revisions with the interaction of middle revisions and a (0, 1) dummy variable that takes the value 1 for recessions. For advanced economies, the interaction term is negative and significant, which suggests that information rigidities are lower in times of recession. In terms of magnitude, about half of the extent of the smoothing is

Table 5
Information rigidities in fiscal forecasts.

Country group	Independent variables			*R*-squared
	Middle revision	Initial revision	Constant	
All	0.36*** (0.02)	–	0.07*** (0.01)	0.16
All	0.34*** (0.02)	0.07*** (0.02)	0.09*** (0.01)	0.17
Advanced	0.33*** (0.02)	–	−0.10*** (0.01)	0.24
Advanced	0.31*** (0.02)	0.05** (0.02)	−0.12*** (0.01)	0.25
Emerging	0.36*** (0.02)	–	0.13*** (0.01)	0.16
Emerging	0.35*** (0.02)	0.07*** (0.02)	0.16*** (0.02)	0.17

Note: The dependent variable is the final revision (refer to the main text for the definition). As for the independent variables included in each regression, these are identified in columns 3 and 4 together with a constant term (column 5). Heteroskedastic-consistent robust standard errors are reported in parenthesis.
* Significance at 10%.
** Significance at 5%.
*** Significance at 1%.

Table 6
Information rigidities during recessions.

Country group	Independent variables			R-squared
	Middle revision	Interaction	Constant	
All	0.47*** (0.03)	0.11 (0.08)	0.11*** (0.02)	0.17
Advanced	0.56*** (0.04)	−0.29*** (0.06)	−0.14*** (0.02)	0.17
Emerging	0.47*** (0.03)	0.13 (0.08)	0.19*** (0.02)	0.17

Note: The dependent variable is final revisions (refer to the main text for the definition). "Interaction" refers to the product of middle revisions with a (0, 1) recession dummy that takes the value 1 for recessions. Heteroskedastic-consistent robust standard errors are reported in parenthesis.
* Significance at 10%.
** Significance at 5%.
*** Significance at 1%.

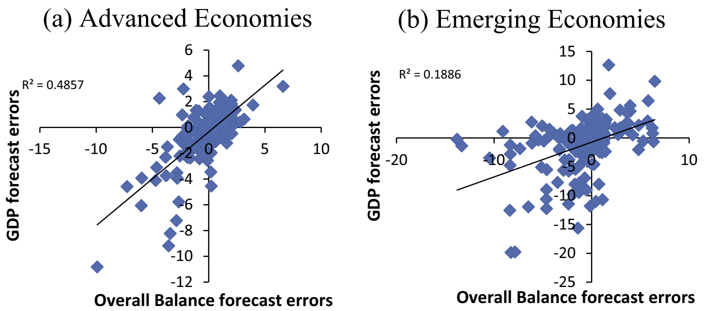

Fig. 2. Budget balance and GDP growth forecast errors, 1993–2009. Note: scatters present the yearly average forecast error by country group between 1993 and 2009 for current year forecasts.

Table 7
The role of growth and inflation forecast errors

Model	eg C	$e\pi$ C	eg Y	$e\pi$ Y	eg C	$e\pi$ C	eg Y	$e\pi$ Y
	I – Pooled OLS				II – Panel Fixed Effects			
Spec.	(1)		(2)		(3)		(4)	
Pooled	0.22** (0.089)	0.00 (0.00)	0.30*** (0.043)	0.002* (0.001)	0.18*** (0.051)	0.01*** (0.000)	0.29*** (0.063)	0.02*** (0.001)
Advanced	0.48*** (0.126)	0.09 (0.175)	0.59*** (0.085)	0.37** (0.159)	0.48*** (0.125)	0.005 (0.197)	0.62*** (0.077)	0.35** (0.147)
Emerging	0.19* (0.102)	0.001 (0.001)	0.26*** (0.050)	0.003** (0.001)	0.13*** (0.043)	0.01*** (0.000)	0.24*** (0.055)	0.02 (0.001)
	III – System GMM				IV – Driscoll-Kraay Estimator			
	(5)		(6)		(7)		(8)	
Pooled	0.27*** (0.084)	0.04 (0.045)	0.31*** (0.080)	0.005 (0.008)	0.18*** (0.075)	0.01*** (0.001)	0.29*** (0.090)	0.02*** (0.002)
Advanced	0.48 (0.351)	0.12 (0.509)	0.77** (0.330)	0.26 (0.508)	0.48*** (0.123)	0.01 (0.199)	0.62*** (0.055)	0.35* (0.195)
Emerging	0.29*** (0.095)	−0.003 (0.050)	0.27** (0.124)	0.01 (0.014)	0.13* (0.07)	0.01*** (0.001)	0.24*** (0.085)	0.02*** (0.002)

Notes: This table presents the estimates of a regression of the budget-balance-to-GDP ratio forecast errors on the forecast errors of both GDP and inflation for the pooled sample plus two sub-samples containing either advanced or emerging countries. Model I estimates by pooled OLS. Model II estimates with panel fixed effects (this was selected as the preferred model relative to the random effects alternative with a Hausman–Wu type test). Model III relies on the Arelano-Bover (1995) system GMM. Finally, Model IV uses Driscoll-Kraay (1998) robust standard errors which correct for autocorrelation and cross-sectional dependence. For information on the composition of each sub-sample refer to the main text. Heteroskedastic-consistent robust standard errors are reported in parenthesis. For reasons of parsimony the constant is not reported. The suffices Y and C refer to year-ahead and current-year forecasts, respectively.
* Significance at 10%.
** Significance at 5%.
*** Significance at 1%.

Table 8
Forecast performance of consensus budget balance-to-GDP ratio during recession episodes.

Forecast horizon	April($t-1$)	October($t-1$)	April(t)	October(t)
Number of episodes where forecast was too optimistic (Forecast > Actual)	33	37	35	26
Average forecast error (all episodes)	−1.66	−1.24	−1.09	−0.62
Advanced countries	−1.39	−0.67	−0.86	−0.18
Emerging countries	−2.06	−1.98	−1.39	−1.06

Note: Refer to the main text for details.

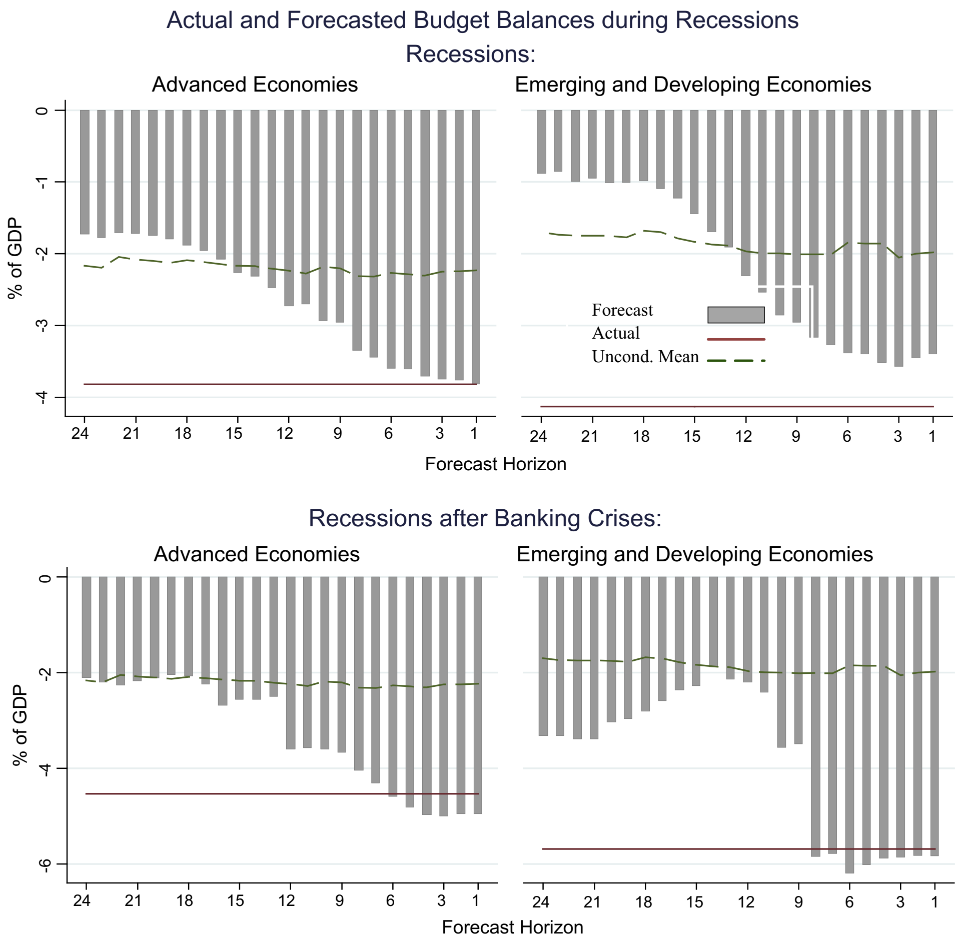

Fig. 3. Actual and forecasted budget balances (% GDP) in recessions: consensus 1993–2009.

erased; hence there are still information rigidities but forecasts are revised more extensively at the onset of a recession. For emerging markets, the interaction is not significant.

In the next section, we study the pattern of forecast revisions around turning points in greater detail and also investigate the sources of errors in fiscal forecasts.

4. Forecasts of budget balances around turning points

4.1. Sources of forecast errors

Fig. 2 shows a positive association between budget balance-to-GDP forecast errors and errors in forecasting GDP growth.[8] This holds for both for advanced and emerging economies but is stronger in the former group.

[8] Note that if this association were driven simply by the fact that GDP occurs in both variables, the correlation would be negative.

Table 7 provides more formal evidence by regressing budget balance-to-GDP forecast errors on growth and inflation forecast errors. Afonso and Silva (2012) suggest that "higher inflation can influence budget balances through the imperfect tax indexation system" and hence errors in forecasting inflation can get transmitted to fiscal forecast errors. The regressions are carried out separately for current-year and year-ahead forecasts and using four different estimation methods. Growth forecast errors have a positive impact on fiscal forecast errors and in all cases but one shown in the table the impact is statistically significant. Inflation errors are important in explaining errors in year-ahead forecasts, particularly in advanced economies.

4.2. Forecast errors around turning points

Some basic properties of budget balance-to-GDP forecasts during recession years are summarized in Table 8.

The first row shows while forecasters recognize a deterioration of the budget balance during recessions, the magnitude of the almost always under-predicted. For instance, in October the forecasted budget balanced exceeded its actual realization in 26 out of the 48 episodes. The rows that follow show the average forecast error at four forecast horizons over all recession episodes and also for the advanced and emerging countries separately. For recession episodes, the bias towards optimism persists even in the case of advanced economies until April of the year of the recession and also dissipates as the year is drawing to a close. For emerging markets, the bias is much larger and persists even until October of the year of the recession.

The analysis of the time profile of forecast errors shows that forecasters do anticipate a deterioration of the budget balance in the middle of the year preceding the recession year (Fig. 3). A year prior to the recession year, forecasts are close to the unconditional average, especially for advanced economies. Around July–October of that year, forecasters start marking down forecasts, although they continue to overestimate the budget balance well into the recession year. This pattern holds both for advanced and emerging economies. During recessions after banking crises in emerging countries, forecasters usually start marking down forecasts of the budget balance at the beginning of the recession year, but up to that point we see a gradually increase in forecast errors.

The above analysis has documented failures in forecasting of recessions and discussed possible reasons that may explain them. Naturally a question arises about forecast performance during recoveries, another turning point of the business cycle. We explore this question briefly. In Fig. 4, if we now look at the recoveries' line, we see that by April of the recovery year in advanced economies budget balances' forecast errors turn positive, meaning that we have some overestimation of the budget deficits and the forecasters' pessimism persist. Note that for emerging economies the forecast errors switch to positive in October of the year preceding the recovery. Budget balances' improvements during recoveries are also apparently difficult to predict, with most forecasters not being able to anticipate a budget balance reversal until about 3 months prior

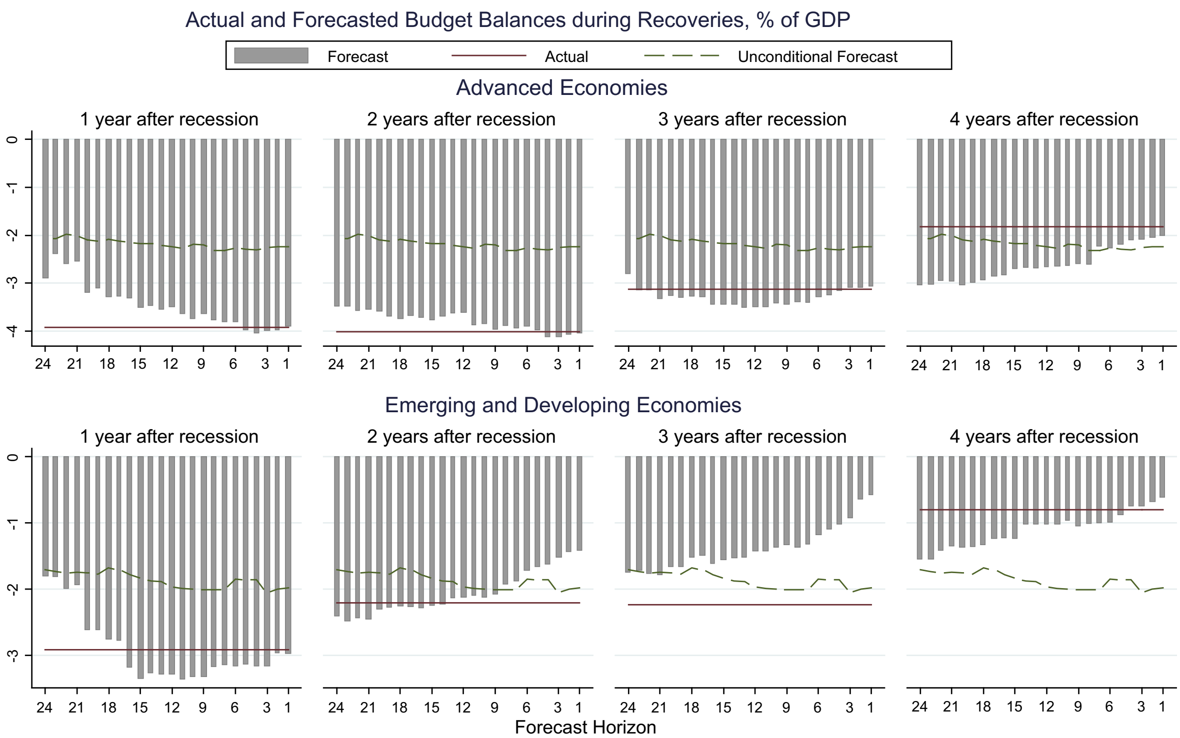

Fig. 4. Actual and forecasted budget balances (% GDP) in recoveries.

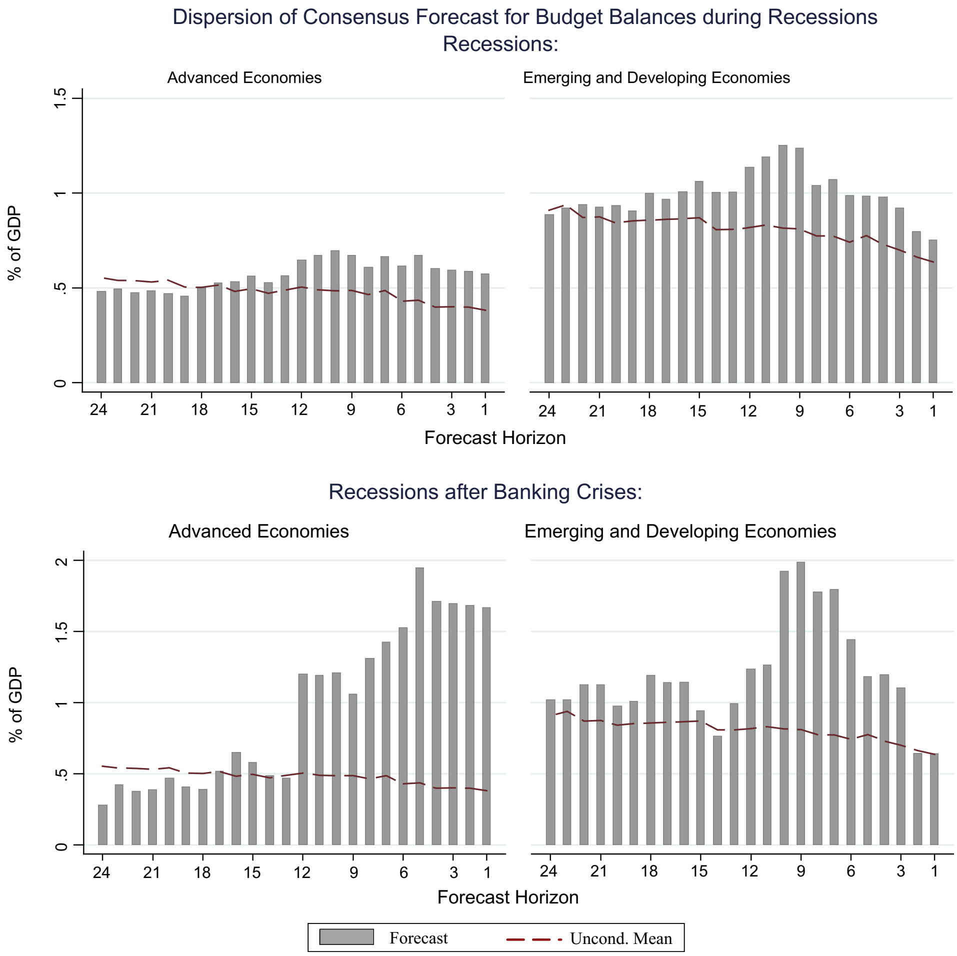

Fig. 5. Dispersion of budget balances forecasts (% GDP) in recessions.

Table 9
Dispersion of consensus forecasts of budget balance-to-GDP ratio in the run-up to recession.

Months before the onset of recession	Advanced countries		Emerging countries	
	Coeff.	St. error	Coeff.	St. error
12	0.12	0.09	0.24*	0.14
11	0.12	0.09	0.46***	0.14
10	0.14*	0.09	0.46***	0.13
9	0.17**	0.09	0.57***	0.14
8	0.10	0.08	0.41***	0.13
7	0.13*	0.08	0.30**	0.13
6	0.09	0.08	0.30**	0.13
5	0.18**	0.08	0.22*	0.13
4	0.14*	0.08	0.27**	0.13
3	−0.04	0.09	0.29**	0.13
2	−0.03	0.09	0.23*	0.13
1	−0.04	0.09	0.10	0.13
Horizon	0.01***	0.00	0.01***	0.00
Constant	0.30***	0.02	0.64***	0.02
Obs.		3652		4766
R-squared		0.04		0.03

Note: The dependent variable is the dispersion of forecasts. The regression includes dummy variables for the 12 months preceding the onset of a recession, a variable measuring the horizon of the forecast and a constant term.

* Significance at 10%.
** Significance at 5%.
*** Significance at 1%.

to an "official" recovery starts taking place (Fig. 5). Hence, there is a sense of "pessimism" going on amongst forecasters up to 3 years after the end of the recession in the case of advanced economies; in other words, the "actuals" line only shifts upwards after 2 years but the budget balance predictions' path only improve as of 3 years after the end of the recession and up until then they overestimate the budget deficit. For emerging countries "pessimism" lasts for a much shorter period with both "actuals" shifting in the "right" direction and budget balance forecasts being revised upward (and fast) as we move away from the end of the recession.

4.3. Dispersion of budget balance forecasts

As noted earlier, our analysis thus far has been based on the mean of the individual forecasts. We also study briefly the behavior of the standard deviation or dispersion of forecasts. Fig. 5 compares the behavior of dispersion around recessions to the unconditional (or average) values of dispersion. As shown in the top panel, for both advanced and emerging economies, dispersion during recession episodes rises above its unconditional value; this is particularly true for emerging economies. For recessions associated with banking crises, the departures from the unconditional values are even more pronounced, as shown in the bottom panel of Fig. 5.

The regression analysis in Table 9 confirms these findings. Dispersion is regressed on monthly dummies for each of the twelve months before the onset of a recession. The regressions also include a variable called 'horizon', which as before indexes the sequence of forecasts ($h = 1, 2 \ldots 24$, with $h = 1$ indicating the end of the forecasting horizon). We expect the coefficient on this variable to be positive as the dispersion in forecasts should decline as the forecast horizon draws to a close and the outcomes start to become known. Controlling for this effect, we see that there is a statistically significant increase in dispersion in the run-up to a recession, with the impact particularly noticeable in emerging markets. Hence, looking at dispersion of forecasts could serve as a leading indicator to help to improve forecast performance around turning points.

5. Concluding remarks

This paper provides systematic evidence on the quality of private sector forecasts of the budget balance for advanced and emerging economies. We find that, on average, there is a big difference in the bias and accuracy of forecasts for the two groups of countries. For advanced economies, forecasts made a year in advance are biased—they are more optimistic about the budget balance than turns out to be the case—but the bias does not persist in current-year forecasts. Forecasts for emerging economies are biased, also towards optimism, for both year-ahead and current-year forecasts; they are also much less accurate than the forecasts for advanced economies.

Forecasts for both groups of countries do share a common feature, however: there is evidence of smoothing of forecasts in a manner that is inconsistent with full informational rational expectations. Instead, the correlation of forecast revisions with past revisions is consistent with theories of information rigidities, as discussed by Coibion and Gorodnichenko (2013), Dovern et al. (2015) and Coibion (2015).

The tendency to smooth forecasts ends up proving costly around turning points. It is well known that turning points in real GDP have proved difficult to forecast, as noted by Loungani (2001) and Ahir et al., (2015). Hence, turning points in fiscal balances are also missed, leading to large errors. Moreover, the practice of forecast smoothing means that fairly large errors continue to be made over the course of the recession episode. There is also some evidence of a similar error being made for advanced economies during recoveries: forecasters are too slow to recognize the turnaround in the economy—and the consequent increase in the fiscal balance—and forecasts end up being too pessimistic. We find that the dispersion of forecasts (the standard deviation across individual forecasters) can serve as a leading indicator of turning points and could therefore be used to improve the accuracy of forecasts.

To sum up, while we support Frankel and Schreger's (2014) view that adding private sector forecasts in the policy process is useful given their lower 'optimism bias' compared to government forecasts, our findings show that private sector forecasts also have several limitations and could be improved.

Acknowledgments

The authors are grateful to Allan Timmermann, Andrew C. Harvey, Ken West, Mark Watson, Fred Joutz, Herman Stekler, Tara Sinclair, Neil Ericsson, Laura Feiveson, Ad van Riet, Jacopo Cimadomo and Petra Geraats for useful comments and suggestions. Insights from participants at the NBER Summer Institute (EFWW group), George Washington University Forecasting Seminar, University of Cambridge Macro Workshop and the European Central Bank's Fiscal Policies Seminar are also acknowledged. Thanks also go to Jair Rodriguez and Angela Espiritu for research assistance and to an anonymous referee. The usual disclaimer applies. The views expressed are those of the authors and do not necessarily represent those of the IMF or its members.

Table A.1
Bias.

Spec.	USA (1)	Japan (2)	Germany (3)	France (4)	Italy (5)	UK (6)	Canada (7)
Full sample							
Year Ahead April (t − 1)							
α	−0.68	−0.43	−0.10	−0.78**	−0.22	−0.88	0.24
	(0.66)	(0.70)	(0.42)	(0.37)	(0.38)	(0.54)	(0.30)
Current Year October (t)							
α	0.18*	−0.17	0.42*	−0.23	0.003	−0.42	0.33*
	(0.10)	(0.32)	(0.20)	(0.14)	(0.13)	(0.26)	(0.17)
1993–2001							
Year Ahead April (t − 1)							
α	1.11**	−1.61	0.53	−0.16	0.47	0.24	0.70*
	(0.31)	(0.71)	(0.59)	(0.35)	(0.54)	(0.59)	(0.35)
Current Year October (t)							
α	0.24***	−0.63	0.79*	−0.36	−0.03	−0.78*	0.50
	(0.06)	(0.46)	(0.35)	(0.29)	(0.16)	(0.37)	(0.33)
2001–2009							
Year Ahead April (t − 1)							
α	−1.70	0.22	−0.34	−1.09*	−0.12	−1.61*	−0.40
	(0.98)	(1.14)	(0.57)	(0.59)	(0.49)	(0.83)	(0.43)
Current Year October (t)							
α	0.24	0.17	0.20	−0.12	0.14	−0.12	0.19
	(0.16)	(0.46)	(0.17)	(0.12)	(0.22)	(0.38)	(0.15)

Note: The dependent variable is consensus forecast error. Each cell reports the results of a regression of forecast errors on a constant. Robust standard errors are reported in parenthesis.
* Significance at 10%.
** Significance at 5%.
*** Significance at 1%.

Appendix A. Results for G-7 countries

This appendix provides results for individual G7 countries for selected tables. These results do not change the main thrust of our conclusions, though clearly there is interesting heterogeneity that can be explored in future work.

A.1. Evidence on bias

In the main text we report regressions of the budget balance forecast error on a constant:

$$A_t - F_{th} = \alpha + \varepsilon_{th}$$

where A_t is the actual value of the budget balance for target year t, F_{th} is the forecast for that target year made at horizon h, ε_{th} is the corresponding forecast error, and $h = 1, 2, \ldots, 24$. Forecasts are unbiased if we cannot reject the null hypothesis that $\alpha = 0$. If the estimated coefficient is negative, forecasts are biased toward optimism.

In Table 2 in the main text we reported, for 2 different forecast horizons, $h = 21$ and $h = 3$, the estimates of α and the corresponding standard errors.[9] For advanced economies as a whole, we found that current year forecasts do not display a bias towards optimism; and even the optimism bias in the year ahead forecasts arises during the latter time period (2001–2009) and not in the earlier one (1993–2001). As shown in Table A.1 below, for or the individual G7 countries we find similarly that the year-ahead forecasts display much less optimism bias than the current-year forecasts; in fact, the forecasts for Germany and Canada are significantly pessimistic. It is also the case that the bias toward optimism is stronger in the second time period than in the first.

A.2. Evidence on efficiency

In the paper we delve in the source of the forecast inefficiency. We estimate β by regressing the forecast error on the forecast and ρ by regressing the current-period forecast error on the previous period error:

$$e_t = \alpha + \beta F_t + u_{1t}$$
$$e_t = \gamma + \rho e_{t-1} + u_{2t}$$

[9] We also computed the Ljung-Box Q-statistic for testing up to 3 lags possible serial correlation in the time series of the forecast errors (not shown).

Table A.2
Efficiency regressions

Spec.	USA (1)	Japan (2)	Germany (3)	France (4)	Italy (5)	UK (6)	Canada (7)
Full sample							
Current Year October (t)							
β	0.10	−0.36***	0.12	0.08	−0.08	−0.10	0.05
	(0.09)	(0.10)	(0.21)	(0.12)	(0.07)	(0.10)	(0.10)
ρ	0.57**	0.50***	0.06	0.22	0.13	−0.11	0.15
	(0.20)	(0.14)	(0.29)	(0.25)	(0.26)	(0.37)	(0.19)
Year Ahead April (t−1)							
β	0.02	−0.63***	−0.35	−0.08	−0.40**	−0.07	−0.11
	(0.23)	(0.15)	(0.34)	(0.19)	(0.14)	(0.15)	(0.18)
ρ	0.52***	0.42**	0.31	0.42***	0.35**	0.08	0.43*
	(0.12)	(0.18)	(0.26)	(0.12)	(0.16)	(0.36)	(0.22)
1993–2001							
Current Year October (t)							
β	0.08	−0.45***	0.15	0.28	0.04	0.12	0.13
	(0.05)	(0.05)	(0.58)	(0.33)	(0.06)	(0.11)	(0.14)
ρ	0.30	0.45***	−0.35	0.24	−0.71**	0.25	0.14
	(0.26)	(0.07)	(0.39)	(0.50)	(0.25)	(0.32)	(0.24)
Year Ahead April (t − 1)							
β	−0.12	−0.56***	−0.38	0.28	−0.23	0.34*	0.04
	(0.27)	(0.08)	(0.76)	(0.45)	(0.20)	(0.17)	(0.19)
ρ	−0.15	0.59	−0.62*	0.42	−0.45	0.50	0.14
	(0.50)	(0.33)	(0.29)	(0.29)	(0.35)	(0.36)	(0.27)
2001–2009							
Current Year October (t)							
β	0.11	−0.13	0.21	0.06	−0.29	−0.25***	0.08
	(0.10)	(0.17)	(0.10)	(0.15)	(0.22)	(0.02)	(0.05)
ρ	0.54*	0.59	0.63***	0.18	0.39	−1.39	0.09
	(0.30)	(0.36)	(0.15)	(0.23)	(0.29)	(0.55)	(0.32)
Year Ahead April (t − 1)							
β	−0.14	−0.79	−0.20	−0.15	−0.83*	−0.29***	0.08
	(0.32)	(0.54)	(0.40)	(0.25)	(0.37)	(0.07)	(0.21)
ρ	0.35*	0.39	0.42	0.34*	0.27	−0.25	0.28
	(0.16)	(0.26)	(0.26)	(0.15)	(0.23)	(0.31)	(0.23)

Note: β is the estimated coefficient from a least-squares regression of the forecast error on the forecast, ρ is the estimated coefficient from a least-squares regression of the current period forecast error in the forecast error of the previous period. Robust standard errors are reported in parenthesis.
* Significance at 10%.
** Significance at 5%.
*** Significance at 1%.

Table A.3
The role of growth and inflation forecast errors

Spec.	*eg* C (1)	*eπ* C	*eg* Y (2)	*eπ* Y
USA	0.52***	0.55***	1.05***	0.72***
	(0.08)	(0.19)	(0.04)	(0.07)
Japan	0.33**	−0.08	0.60***	1.14***
	(0.13)	(0.64)	(0.04)	(0.15)
Germany	0.99***	0.37**	0.71***	−0.35***
	(0.05)	(0.15)	(0.03)	(0.09)
France	0.36***	0.47***	0.82***	0.23***
	(0.09)	(0.17)	(0.04)	(0.07)
Italy	0.55***	0.013	0.59***	−0.37***
	(0.05)	(0.14)	(0.04)	(0.09)
UK	0.66***	0.29***	1.29***	0.47***
	(0.17)	(0.10)	(0.02)	(0.07)
Canada	0.39***	0.10	0.39***	0.35***
	(0.09)	(0.15)	(0.04)	(0.11)

Notes: This table presents the OLS estimates of a regression of the budget-balance-to-GDP ratio forecast errors on the forecast errors of both GDP and inflation. Robust standard errors are reported in parenthesis. For reasons of parsimony the constant is not reported. The suffices Y and C refer to year-ahead and current-year forecasts, respectively.
*Significance at 10%.
** Significance at 5%.
*** Significance at 1%.

where e and F denote forecast error and forecast, respectively.

In Table 4 in the main text, we show that for the advanced economies as the whole the estimates of β are all essentially zero, while the estimate of ρ is statistically significantly different from zero. The results for the individual G7 countries are shown in Table A.2. We find that the vast majority of the estimates of β are zero (in 36 out of the 42 cases shown). The estimates of ρ are positive in the vast majority of cases (in 34 out of 42 cases shown) but given the smaller number of observations they are not measured very precisely and there are some cases of a negative estimate of ρ.

A.3. Sources of forecast errors

In Table 7 in the main text show that for advanced economies as a whole, growth forecast errors have a positive impact on fiscal forecast errors and inflation errors are important in explaining errors in year-ahead forecasts. These conclusions hold for the individual G7 countries as well, as shown in Table A.3.

References

Afonso, A., Silva, J., 2012. The Fiscal Forecasting Track Record of the European Commission and Portugal. Department of Economics at the School of Economics and Management (ISEG), Technical University of Lisbon.

Ahir, H., Jalles, J.T., Loungani, P., 2015. Fail Again? Fail Better? Output Forecasts by Economists Around Turning Points. Working paper.

Annett, A., 2006. Enforcement and the Stability and Growth Pact: How Fiscal Policy Did and Did not Change under Europe's Fiscal Framework. Working Paper 06/116, International Monetary Fund, Washington, DC.

Artis, M., 1988. How accurate is the world economic outlook? A post mortem on short term forecasting at the international monetary fund. IMF WEO Staff Stud. (July), 1–49

Artis, M., 1996. How Accurate are the IMF's Short-Term Forecasts? IMF WP/96/89.

Artis, M.J., Marcellino, M., 2001. Fiscal forecasting: the track record of the IMF, OECD and EC. Econom. J. 4, 20–36.

Barrionuevo, J.M., 1996. How accurate are the World Economic Outlook projections? Staff Stud. World Econ. Outlook (International Monetary Fund).

Coibion, O., 2015. Comments on Dovern, Fritsche, Loungani and Tamirisa. Int. J. Forecast. 31 (1), 155–156.

Coibion, O., Gorodnichenko, Y., 2012. What can survey forecasts tell us about informational rigidities? J. Polit. Econ. 120, 116–159.

Coibion, O., Gorodnichenko, Y., 2013. Information Rigidity and the Expectations Formation Process: A Simple Framework and New Facts. Working paper, UT Austin.

Debrun, X., Hauner, D., Kumar, M., 2009. Independent fiscal agencies. J. Econ. Surv. 23, 44–81.

Dovern, J., Fritsche, U., Loungani, P., Tamirisa, N., 2015. Information rigidities: comparing average and individual forecasts for a large international panel. Int. J. Forecast. 31 (1), 144–154.

Frankel, J.A., 2011. Over-optimism in forecasts by official budget agencies and its implications. Oxford Rev. Econ. Policy 27, 536–562.

Frankel, J.A., 2012. Budgetary Wishful Thinking. Project Syndicate column. <http://www.project-syndicate.org/commentary/budgetary-wishful-thinking>.

Frankel, J.A., Schreger, J., 2013. Over-optimistic official forecasts and fiscal rules in the Eurozone. Rev. World Econ.

Frankel, J.A., Schreger, J., 2014. Bias in Official Fiscal Forecasts: Can Private Forecasts Help? mimeo, Harvard University.

Heppe-Falk, K., Hufner, F., 2004. Expected Budget Deficits and Interest Rate Swap Spreads: Evidence for France, Germany and Italy. Deutsche Bundesbank Discussion Paper 40/2004.

Ho, G., Mauro, P., 2014. Growth: Now and Forever? IMF Working Paper No. 14/117.

Holden, K., Peel, D.A., 1990. On testing for unbiasedness and efficiency of forecasts. Manch. Sch. 63, 120–127.

International Monetary Fund, 2009. Fiscal Rules—Anchoring Expectations for Sustainable Public Finances. Fiscal Affairs Department.

Jonung, L., Larch, M., 2006. Fiscal policy in the EU: are official output forecasts biased? Econ. Policy, 491–534.

Laeven, L., Valencia, F., 2008. Systemic Banking Crises: A New Database. IMF Working Paper, WP/08/224.

Leal, T., Perez, J.J., Tujula, M., Vidal, J.-P., 2008. Fiscal forecasting: lessons from the literature and challenges. Fiscal Stud. 29, 347–386.

Loungani, P., 2001. How accurate are private sector forecasts? Cross-country evidence from consensus forecasts of output growth. Int. J. Forecast. 17, 419–432.

Loungani, P., Stekler, H., Tamirisa, N., 2013. Information rigidity in growth forecasts: some cross country evidence. Int. J. Forecast. 29 (4), 605–621.

Mankiw, N.G., Reis, R., 2002. Sticky information versus sticky prices: a proposal to replace the New Keynesian Phillips curve. Quart. J. Econ. 117, 1295–1328.

Milesi-Ferretti, Maria, Gian, 2004. Good, bad or ugly? On the effects of fiscal rules with creative accounting. J. Pub. Econ. 88.1, 377–394.

Moulin, L., Wierts, P., 2006. How credible are multiannual budgetary plans in the EU? In: Fiscal Indicators, 983–1005, Banca d'Italia.

Muhleisen, M., Danninger, S., Hauner, D., Krajnyak, K., Sutton, B., 2005. How do Canadian Budget forecasts compare with those of other industrial countries? Washington, International Monetary Fund, IMF Working Paper 05/66.

Nordhaus, W.D., 1987. Forecasting efficiency: concepts and applications. Rev. Econ. Stat. 69, 667–674.

Pina, Alvaro M., Venes, Nuno M., 2011. The political economy of EDP fiscal forecasts: an empirical assessment. Eur. J. Polit. Econ. 27, 534–546.

Pons, J., 2000. The accuracy of IMF and OECD forecasts for G-7 countries. J. Forecast. 19, 53–63.

Poplawski-Ribeiro, M., Rulke, J.-C., 2011. Fiscal expectations under the Stability and Growth Pact: Evidence from Survey Data. IMF Working Paper wp/11/48.

Sims, C., 2003. Implications of rational inattention. J. Monet. Econ. 50 (April), 665–690.

Strauch, R., Hallerberg, M., Von Hagen, J., 2004. Budgetary Forecasts in Europe – The Track Record of Stability and Covergence Programmes. European Central Bank WP 307.

Woodford, M., 2001. Imperfect Common Knowledge and the Effects of Monetary Policy. Princeton University (In Honor of Edmund S. Phelps, P. Aghion, R. Frydman, J. Stiglitz, M. Woodford (Eds.), Knowledge, Information, and Expectations in Modern Macroeconomics, Princeton, NJ: Princeton University Press; forthcoming).