An Assessment of the IMF's Forecasts of Unemployment for Advanced and Developing Economies

Zidong An
American University and IMF

Laurence Ball
Johns Hopkins University and IMF

Joao Jalles
IMF

Prakash Loungani
IMF

April 19, 2017

Keywords: Okun's Law; Unemployment forecasts; Forecast assessment
JEL codes: C53, E27, E37, E62, D8

1. Introduction

The IMF is the world's largest supplier of publicly-available forecasts of unemployment. But while the institution's forecasts of real GDP growth receive extensive scrutiny in both academia and the media, its unemployment forecasts—arguably of greater interest to the person on the street—have hardly been analyzed. This paper provides an assessment of the quality of the IMF's unemployment forecasts, focusing particularly on the consistency between unemployment and growth forecasts. In this respect our work contributes to the recent literature on multivariate assessment of forecasts. Sinclair, Stekler and Carnow (2012) note that forecast evaluation methods have traditionally examined forecasts of individual variables. However, as they suggest, forecasts are "often relied upon to provide a holistic picture of the state of the economy. In that case the forecasts of all important variables should be evaluated jointly in a multivariate framework."

Testing the consistency between unemployment and growth forecasts is also important since the two variables are likely to be related in the data through Okun's Law. As Mitchell and Pierce (2010) state, "if stable empirical relationships exist among macroeconomic variables, we should expect the public forecasts of professional economic forecasters to be generally consistent with these relationships." For the United States, Okun (1962) reported a negative short-run correlation between unemployment and output that has become a staple of macroeconomic textbooks.[1] Ball, Leigh and Loungani (forthcoming) show that Okun's Law is a fairly stable relationship for 20 advanced economies, though the Okun coefficient—the responsiveness of unemployment to growth—varies considerably across countries. Ball, Furceri, Leigh and Loungani (2016) study Okun's Law for a large group of advanced and developing economies. They find that while the Okun coefficient is lower on average in developing than in advanced economies, the notable feature is the heterogeneity in the size of the coefficient within each group.

[1] Blanchard and Fischer (1989) include it in their chapter on useful models in *Lectures on Macroeconomics*. Blinder (1997) refers to it as a "truly sturdy empirical regularity" that constitutes "the core of practical macroeconomics that we should all believe". Leading textbooks such as Mankiw (2012) and Romer (2012) feature Okun's Law as an empirical fact.

Some recent papers have looked at forecasters' belief in Okun's Law. Mitchell and Pearce (2010) used forecasts for the United States for 1999 and 2007 from the *Wall Street Journal*'s semi-annual survey and found that "predictions of unemployment and real growth move in opposite directions, as per Okun's Law." For the period 1999 to 2007, the Okun coefficient—the responsiveness of unemployment changes to GDP growth—is about -0.6 in the data and about -0.75 in the forecasts.

Ball, Jalles and Loungani (2015) used *Consensus Forecasts* to extend the coverage to nine countries—the G7 plus Australia and New Zealand—and extended the sample to cover the period of the Great Recession, which subjected Okun's Law and forecasters belief in it to a severe test. They found that *Consensus* forecasters believe in Okun's Law to a degree merited by how well it holds in the data. For all nine countries, the relationship between forecasts of the change in unemployment and real GDP growth was negative, which is consistent with Okun's Law. Moreover, the variation across countries in the Okun coefficient lined up well in the forecasts and the data. In particular, the small magnitudes of the Okun coefficients for Japan and Italy found in the data also held true for the forecasts. Forecasters' belief in Okun's Law also held up during the Great Recession, mirroring its survival in the data.[2]

This paper significantly expands the set of countries and, to our knowledge, is the first to analyze unemployment forecasts for developing economies. The source of the data used here is the IMF's *World Economic Outlook*. We study 84 economies for which forecasts are available for a long enough time span, 1990 to 2014, that we can reliably estimate whether Okun's Law holds. We group economies into high-income, middle-income and low-income based on the World Bank's 2005 classification. The list of countries and the group to which they belong in our sample is given in Table 1.

The remainder of the paper is organized as follows. Section 2 describes the data and discusses how we compare estimates of the Okun coefficient from forecasts to those in the data.

[2] Pierdzioch, Rülke and Stadtmann (2011) also used forecasts from *Consensus Economics* for the G7 from 1989 to 2007 to study forecasters belief in Okun's Law. A strength of their work is that they use individual-level forecasts, instead of the average (the "consensus").

Section 3 presents our main empirical results. Section 4 presents evidence on the relationship between unemployment and growth forecasts for those periods where the countries have a loan from the IMF, generally referred to as "program countries". Conclusions are in Section 5.

2. Okun's Law in Data and Forecasts

2A. Description of Forecasts

The IMF undertakes a major assessment of the global outlook each April and October and reports forecasts of the main macroeconomic variables in its *World Economic Outlook* (WEO). The events being forecast are the annual average unemployment rate and annual average real GDP growth. Each WEO reports forecasts for these variables for the current year and the following year. Hence for each target year, t, we have a sequence of four forecasts, the ones reported in the WEO publications of year t-1 and the ones reported in the WEO publications of year t. We refer to the former as year-ahead forecasts and the latter as current-year forecasts and use the labels Apr(t-1), Oct(t-1), Apr(t) and Oct(t) to denote them. For comparison with Consensus Forecasts, which are updated monthly or bi-monthly, it will be useful to use *h* to index the forecasting horizon of 24 months from January(t-1) to December(t), during which four WEO forecasts are made (i.e. h=21, 15, 9 and 3). In addition to forecasts, our data set includes (actual) real GDP growth and unemployment rates from the IMF's WEO database.

The bias and accuracy of the unemployment forecasts are reported in Table 2. The forecast errors are defined as actual values minus the forecasts, so a positive error for the case of unemployment means that there was 'optimism' about the outcome. If one averages across all countries, there is some evidence of a mild bias towards optimism in the Apr(t-1) forecasts, which dissipates, and in fact ends up in mild pessimism, in the forecasts made closer to the end of the forecast horizon. This pattern is driven by the high-income and middle-income countries; for low-income countries the pattern is the opposite. In any event, the bias is not quantitatively large relative to the mean and standard deviation of unemployment. Reassuringly, accuracy improves as the forecast horizon draws to a close: the RMSE for all country groups declines monotonically from the Apr(t-1) forecast to the Oct(t) forecast.

Since Consensus Forecasts for unemployment are only available for nine countries, the ability to assess IMF forecasts by comparing them to an alternative is limited. However, for this limited set of countries there is little difference between the IMF and Consensus forecasts, as shown in Table 3.

2B. Estimating Okun's Law: Data and Forecasts

Okun's Law is generally written as:

$$(1) \qquad U_t - U_t^* = \beta\,(Y_t - Y_t^*) + \varepsilon_t \qquad \beta < 0$$

where U_t is the unemployment rate, Y_t is the log of output and the * indicates a long-run level. The magnitude of the Okun coefficient depends on the costs of adjusting employment, which include both costs of training and costs created by employment protection laws. The coefficient also depends on the number of workers who entering and exit the labor force as employment fluctuates. Since these factors differ across countries, the Okun coefficient also differs across countries.

In addition to the "levels" or "gap" version shown in equation (1), there is a "changes" version of Okun's Law:

$$(2) \qquad \Delta U_t = \alpha + \beta\,\Delta Y_t + \omega_t$$

where Δ is the change from the previous period. This equation follows from equation (1) if the natural rate U^* is assumed to be constant and potential output Y^* is assumed to grow at a constant rate. In this case, differencing equation (1) yields equation (2) with $\alpha = -\beta\,\Delta Y^*$, where ΔY^* is the constant growth rate of potential output, and $\omega_t = \Delta\,\varepsilon_t$.

In principle, it is better to estimate equation (1) because the implicit assumptions of a constant natural rate of unemployment and constant long-run growth rate of output may not always be reasonable, particularly for developing economies. In this paper, however, we rely on

estimates of equation (2). The reason is that we do not have forecasters' estimates of U^* and Y^*, which would be needed to compare estimates of Okun's Law in the data with that in the forecasts using equation (1). This limitation of our analysis may not be too severe, however, as Ball et al (2016) show that for most countries, the estimates of the Okun coefficient from the two version of the Law are quite similar.

We estimate the following version of equation (2) using forecasts:

$$(3) \qquad E_h \Delta U_t = \alpha + \beta E_h \Delta Y_t$$

where $E_h \Delta U_t$ and $E_h \Delta Y_t$ are the forecasts made at horizon h of the change in unemployment and real GDP growth. As noted earlier, h takes the values 3, 9, 15 and 21, corresponding to the Apr(t), Oct(t), Oct(t-1) and Apr(t-1) forecasts. In the empirical work we will report regression results for these different values of h.

Obtaining the independent variable in equation (3), $E_h \Delta Y_t$, is easy since we directly have forecasts of real GDP growth. The dependent variable, $E_h \Delta U_t$, has to be constructed as we have forecasts of the unemployment rate rather than of the change. We compute $E_h \Delta U_t$ as the difference between the forecasted value of unemployment for next year and the most recent forecasted value for this year. Hence,

$$(4) \qquad E_h \Delta U_t = E_h U_t - E_h U_{t-1}$$

So, for example, $E_{21} \Delta U_{2000}$ is the difference between the forecast of unemployment in 2000 made in April 1999 and the forecast for 1999 unemployment made that month.

Of course, once U_{t-1} is known, we can replace $E_h U_{t-1}$ by U_{t-1} and instead construct:

$$(5) \qquad E_h \Delta U_t = E_h U_t - U_{t-1}$$

For example, $E_3 \Delta U_{2000}$ is the difference between the forecast of unemployment in 2000 made in April 2000 and the unemployment rate in 1999. One complication is that the point at which U_{t-1} can be assumed to be known differs by country. In the United States, monthly unemployment rates are released with a one month lag; in other countries, the lag is generally longer. Because of these lags, we estimate equation (5) for h = 3 and 9 and equation (4) for h = 15 and 21.

3. Results

We estimate Okun's Law using unemployment changes and real GDP growth using annual data from 1990 to 2014; a similar relationship is estimated for the forecasts for each of the four horizons. We have estimated these regressions both by OLS and as a system of five equations using seemingly unrelated regressions (SUR). In the main text of the paper, we present the SUR results, with OLS results contained in an appendix.

Table 4 contains the core results which will be the basis for the discussion in this section. The table is organized in three panels, one for each of the country groups. The numbers shown in the five columns are the estimates of the Okun coefficient, β, in the data and for the four forecast horizons. Estimates that are not significantly different from zero are shown in italics. Estimates shown in bold indicate cases where the coefficient in the forecasts is significantly different from that in the data. For example, for the United States (last row panel A), all five estimates are significant and the coefficients for the forecasts are not significantly different from in the data: the estimates do not deviate much from about -0.3, the value for the data. In contrast, for Spain, the estimates—while all significantly different from zero—differ significantly for three of the forecasts horizons from that in that in the data; the Apr(t-1) forecasts, for example, are only about half as large as in the data (in absolute terms).

The main results from Table 4 for the three income groups can be summarized as follows. For the 33 high-income countries, the Okun coefficient is negative in all cases and significantly different from zero in all cases but two (Kuwait and Malta). With the exception of the Bahamas and Spain, the coefficient estimates are clustered between -0.1 and -0.4. For the year-ahead forecasts, the Okun coefficient differs from that in the data in a little under half the cases, with

roughly just as many cases where the coefficient is smaller than in the data as the other way around. For the current-year October forecast, however, the coefficient for forecasts departs from that in the data in 19 cases, and in all cases but one the coefficient for forecasts is larger in absolute terms than that in the data.

For the 23 middle-income countries, the Okun coefficients are again all negative and significantly different from zero in all cases but one (Romania). The coefficients for the year-ahead forecasts are different from those in the data in half to two-thirds of the cases, and in most cases are smaller than those in the data in absolute terms. For Poland, for instance, the coefficient in the data is -0.49, compared to -0.02 in the Apr(t) forecasts; in Lithuania, the corresponding numbers are -0.40 and -0.11. For the Oct(t) forecasts, there are still significant deviations in about half the cases but no pattern in the sign of the deviation (in contrast to the evidence for high-income countries).

For the 28 low-income countries, the Okun coefficient is almost always negative but it is not significantly different from zero in about half the cases and the absolute magnitude is small except in a few cases (such as Colombia, which has a coefficient of -0.37). In ten cases, the coefficient for the Apr(t-1) forecasts deviates significantly from that in the data (for Colombia the coefficient is 0.10). For the Oct(t) forecasts, there are again ten significant deviations and the majority of them 'overshoot' the actual coefficient.

The results just discussed are summarized in Table 5 and in Figure 1. The table shows that Okun's Law holds well in the data for high-income and middle-income economies and not as well for low-income countries. The biggest gap between the Okun coefficients in the data and the forecasts occurs for the year-ahead forecasts for the middle-income countries. Figure 1 illustrates this by presenting the average value and the interquartile range of the Okun coefficient in the data and the forecasts for the full sample and for each of the country groups. For the middle-income group, the average value of the Okun coefficients for the Apr(t-1) and Oct(t-1) forecasts is less than half that in the data. For the two other groups, the gaps are much smaller.

Figure 2 present scatter plots of the Okun coefficient in the data vs. that in the forecasts. Cases where there is a statistically significant deviation between the two coefficients are shown in green. The correlation between the two sets of coefficients is fairly weak for the Apr(t-1) forecasts but improves considerably by the time of the Oct(t) forecasts. Looking at the breakdown of this evidence by country group, as done in Figure 3, shows a stronger relationship for high-income countries than for the other two groups. In the middle-income group, the correlation remains weak even for the Oct(t) forecasts. For low-income countries, the correlation is weak but improves by the time of the Oct(t) forecasts.

Figure 4 shows the country estimates for the Okun coefficient in the data and for Apr(t-1) and the Oct(t) forecasts. For the high-income group (Figure 4a), Spain is a notable case. It has a high Okun coefficient but the value of the coefficient implicit in the Apr(t-1) forecasts is only half as large. For the G7 countries plus Australia and New Zealand, the correlation between coefficients in the data and forecasts is quite good, similar to the evidence of Ball, Jalles and Loungani (20xx) for Consensus Forecasts. For a number of other European countries (Greece, Ireland, Portugal), the coefficient in the Apr(t-1) is much smaller in absolute magnitude than in the data but the gap has been erased by the Oct(t) forecasts. There are some other interesting cases (Israel, Korea and Taiwan POC), where the Apr(t) forecasts assume no relationship—or even a positive relationship—between unemployment changes and real GDP growth, in contrast to the (small) negative relationship that holds in the data.

For the middle-income countries (Figure 4B), Poland is an interesting case. It has a high Okun coefficient of -0.5, but the corresponding coefficients in the forecasts are 0 and -0.1 for the Apr(t-1) and Oct(t) forecasts respectively. Mauritius presents a similar example. In the case of the Baltic countries (Lithuania, Latvia, Estonia) and for the Czech Republic and Slovakia, there is a sizable gap in the Apr(t-1) forecasts but it is erased by the time of the Oct(t) forecasts. There are a number of countries (South Africa, Chile, Argentina, Turkey, Malaysia and Romania) where the Oct(t) forecasts assume a much stronger relationship between unemployment changes and real GDP growth than that in the data.

For the low-income countries (Figure 4C), Colombia presents an example similar to that of Spain. The Apr(t-1) forecasts assume no relationship (if anything a small positive one) but the Oct(t) forecasts correctly reflect the Okun coefficient in the data of nearly -0.4. El Salvador and Bulgaria are similar in this respect. As in the case of middle-income countries, there are a number of cases (e.g. Algeria, Morocco, Indonesia, Ukraine) where the forecasts assume a much stronger relationship than holds in the data.

We conclude this section by looking at whether the deviation between the Okun coefficient in the data and the forecasts matters for forecast accuracy, as measured by RMSE. Figure 5 shows the relationships between the RMSE of the unemployment forecasts for various countries and the absolute value of the deviation in the Okun coefficient. Figure 6 shows similar relationships by country group and Table 6 has the associated regressions. In the case of high-income countries, the relationship is positive but influenced by an outlier (Spain). For middle-income countries, there is again a positive relationship, particularly for the year-ahead forecasts, and a reasonably strong one in the case of the Oct(t-1) forecasts. For low-income countries, there is essentially no relationship between the deviations and RMSE. To summarize, there is suggestive evidence that for middle-income countries forecast accuracy could be improved by paying greater attention to Okun's Law.

4. Unemployment Forecasts during IMF Programs

Previous work suggests that forecasts made when countries are in IMF programs are characterized by optimism. For instance, Baqir, Ramcharan and Sahay (2005) found that growth outcomes in IMF programs were worse than anticipated in program documents. Luna (2014) also finds optimism for program cases where large loans are made (where 'exceptional access' is provided, in the IMF's jargon). In contrast, a more recent investigation by Christofides, Eicher, Kuenzel and Papageorgiou (2017) finds very small biases in output growth forecasts.

We investigate this issue with our data set, again focusing on whether there are differential patterns on bias in output and unemployment forecasts. There may be a tendency to be more optimistic about the course of unemployment than about output since the former may be

better understood by the common person as an indicator of the social misery likely over the course of a program.

Figure 7 compares the mean forecast error in cases where there is no IMF program with the mean forecast error during years when countries were in an IMF program. The forecast error is defined as forecast minus actual, so for the output growth forecasts a positive number indicates pessimism and a negative number indicates optimism; the opposite is true for the unemployment rate forecast errors. The left panel compares the mean error for output growth forecasts in program vs. non-program cases. For the year-ahead forecasts, the mean error actually indicates greater optimism in cases where there was no program. For the Apr(t) forecasts, there is less pessimism in the program cases than in non-program cases, but the Oct(t) forecast errors are quite similar. In short, there is not much evidence in the output growth forecasts errors to support a claim that forecasts in program cases tend to be optimistic. The pattern for unemployment is quite different, as shown in the right panel. Here the mean errors indicate a bias towards optimism in the program cases, which is not present in non-program cases. The mean forecast error in Apr(t) for instance is 1 percentage point and it dissipates only slowly over the forecast horizon. Hence there is some evidence in favor of the conjecture that the social impacts in program cases may be understated in IMF forecasts.

We also look at whether the residuals in the Okun's Law relationship that we estimated earlier show any tendencies toward bias in program cases. Recall that in our regressions the independent variable is the change in unemployment forecasts. A negative residual therefore indicates that the forecasted decline in unemployment is greater than can be explained by the change in output growth. When we compare the mean residuals between program and non-program cases, we do find a sharp difference in the sign and magnitude of the errors. As shown in Figure 8, in the non-program cases the residuals are small and show a bias towards pessimism. In the program cases the deviations are larger and show a bias towards optimism. The results therefore again suggest a tendency to understate the social impacts in program cases.

We test this conjecture a little more formally by estimating regressions where we try to explain unemployment forecast errors using as independent variables (1) the output growth

forecast error; (2) a dummy variable indicating whether the forecast was made while the country was in a program; and (3) the interaction of the two. That is, we estimate:

$$FE_{ith}^{ur} = \alpha_h + \beta_h \cdot FE_{ith}^{gr} + \gamma_h \cdot FE_{ith}^{gr} * Prog_{i,t-h} + \delta_h \cdot Prog_{i,t-h} + \mu_{ih} + \epsilon_{ith}$$

The results of the estimation are given in Table 7, Panel A. The estimates of δ_h are positive and significant, confirming previous evidence that there is a strong bias towards optimism in program cases relative to non-program cases. As expected, errors in forecasting output growth are inversely associated with errors in forecasting unemployment rates: the estimates of β_h are negative and significant. The interaction term is positive and significant for three of the four horizons. This indicates that, in program cases, unemployment forecast errors depart from their typical relationship with output errors and are less responsive to errors in forecasting output growth.

We have also estimated a similar regressing using as errors in forecasting the change in unemployment rates as the dependent variable:

$$FE_{ith}^{dur} = \alpha_h + \beta_h \cdot FE_{ith}^{gr} + \gamma_h \cdot FE_{ith}^{gr} * Prog_{i,t-h} + \delta_h \cdot Prog_{i,t-h} + \mu_{ih} + \epsilon_{ith}$$

As shown in Panel B, this gives very similar qualitative results.

5. Conclusions

This paper provides an assessment of the IMF's unemployment forecasts, which have thus far not received much scrutiny. For the small set of 12 countries (G7 countries, Australia, New Zealand plus three others) for *Consensus Forecasts* is available, we find that IMF forecasts match this alternate source in accuracy. It would be useful in future work to compare IMF forecasts to those available from other official sources such as the OECD and the World Bank.

The focus of much of our attention is on the internal consistency of the IMF's growth and unemployment forecasts. Here we find that the average performance is good, in the sense that the relationship between the two sets of forecasts is comparable to that which prevails in the data: the Okun coefficient in the forecasts mirrors on average the Okun coefficient in the data. Nevertheless, there is room for improvement, particularly in the year-ahead forecasts and for the

group of middle-income countries. In cases where the Okun coefficient is large in magnitude (e.g. Spain, Poland, Colombia), forecast accuracy could likely be improved by taking this relationship into account when making the unemployment forecasts.

We also assess unemployment forecasts made in cases where the country is in an IMF program. Here we find some interesting evidence of a bias towards optimism in unemployment forecasts even when there is no bias in the output forecasts. In program cases, unemployment forecasts and unemployment forecast errors deviate significantly from their normal relationships with output forecasts and output forecast errors, respectively. This provide suggestive evidence that the social impacts likely to occur over the course of a program are understated.

Table 1. Country List

High (33)		**Middle (23)**	**Low (28)**	
Australia	Norway	Argentina	Pakistan	Paraguay
Austria	Portugal	Barbados	Sudan	Peru
Bahamas	Singapore	Chile	Vietnam	Philippines
Belgium	Slovenia	Costa Rica	Albania	Thailand
Canada	Spain	Croatia	Algeria	Ukraine
Cyprus	Sweden	Czech	Azerbaijan	
Denmark	Switzerland	Estonia	Belarus	
Finland	Taiwan	Hungary	Brazil	
France	United Kingdom	Latvia	Bulgaria	
Germany	United States	Lithuania	Cabo Verde	
Greece		Malaysia	China	
Hong Kong		Mauritius	Colombia	
Iceland		Mexico	Egypt	
Ireland		Panama	El Salvador	
Israel		Poland	Fiji	
Italy		Romania	Georgia	
Japan		Russia	Indonesia	
Korea		Slovak Republic	Iran	
Kuwait		South Africa	Jordan	
Luxembourg		Trinidad and Tobago	Kazakhstan	
Malta		Turkey	Macedonia	
Netherlands		Uruguay	Moldova	
New Zealand		Venezuela	Morocco	

Note: Following the World Bank 2005 Definition, we categorize the 84 countries into three groups: (1) High Income, (2) Upper Middle Income, and (3) Lower Middle and Low Income. The reason we choose 2005 is because it's the middle point of our sample period.

Table 2. Summary Statistics – Bias and Accuracy of IMF Unemployment Forecasts

	(1) All	(2) High	(3) Middle	(4) Low
Apr[t-1]				
Bias – ME	0.24	0.17	0.10	-0.47
Accuracy – RMSE	2.55	1.90	2.92	3.02
Oct[t-1]				
Bias – ME	0.13	0.06	0.10	0.29
Accuracy – RMSE	2.29	1.60	2.54	2.87
Apr[t]				
Bias – ME	0.02	-0.06	-0.11	0.24
Accuracy – RMSE	2.04	1.34	2.20	2.66
Oct[t]				
Bias – ME	-0.03	-0.06	-0.11	0.07
Accuracy – RMSE	1.82	1.13	1.86	2.5
Unemployment Mean	8.65	6.80	9.98	10.29
Std.	5.34	3.97	4.85	6.54

Table 3. Bias and Accuracy – IMF Forecasts vs. Consensus Forecasts

	(1) IMF Forecasts	(2) Consensus Forecasts
Apr[t-1]		
Bias – ME	-0.11	-0.06
Accuracy – RMSE	1.13	1.21
Oct[t-1]		
Bias – ME	-0.17	-0.11
Accuracy – RMSE	0.93	1.07
Apr[t]		
Bias – ME	-0.20	-0.14
Accuracy – RMSE	0.66	0.91
Oct[t]		
Bias – ME	-0.16	-0.11
Accuracy – RMSE	0.56	0.86

Note: This table compares the bias (mean forecast error) and accuracy (root mean forecast error) of IMF forecasts and Consensus Forecasts. The comparison is based on the sample of 12 countries for which Consensus Forecasts of unemployment are available.

Table 4. Okun Coefficients based on Actual Data and IMF Forecasts

Panel A. High income countries

Country	Actual	Apr[t-1]	Oct[t-1]	Apr[t]	Oct[t]
Australia	-0.37	-0.31	-0.42	-0.49	**-0.54**
Austria	-0.15	**-0.28**	**-0.28**	**-0.30**	**-0.22**
Bahamas	-0.75	-0.63	***0.01***	***-0.06***	**-0.43**
Belgium	-0.31	-0.41	-0.42	-0.39	-0.30
Canada	-0.35	-0.30	**-0.25**	**-0.45**	-0.37
Cyprus	-0.19	-0.09	-0.13	-0.22	**-0.43**
Denmark	-0.30	-0.23	-0.28	-0.28	-0.32
Finland	-0.30	-0.47	**-0.59**	**-0.45**	**-0.40**
France	-0.27	-0.32	**-0.37**	**-0.38**	**-0.41**
Germany	-0.21	**-0.36**	**-0.47**	-0.28	**-0.28**
Greece	-0.36	**-0.18**	-0.32	-0.35	**-0.44**
Hong Kong SAR	-0.26	-0.25	-0.21	-0.32	**-0.31**
Iceland	-0.18	-0.11	**-0.30**	**-0.38**	**-0.34**
Ireland	-0.31	**-0.07**	-0.24	-0.30	-0.29
Israel	-0.20	***0.04***	*-0.10*	-0.16	-0.27
Italy	-0.32	-0.28	-0.29	-0.37	**-0.43**
Japan	-0.11	-0.06	-0.14	-0.08	-0.11
Korea	-0.17	***0.13***	**-0.10**	-0.16	-0.17
Kuwait	*-0.01*	-0.03	-0.03	*-0.02*	*-0.02*
Luxembourg	-0.08	***0.04***	***0.02***	**-0.19**	**-0.22**
Malta	*-0.02*	-0.09	-0.08	**-0.18**	**-0.21**
Netherlands	-0.25	-0.24	-0.40	-0.31	**-0.34**
New Zealand	-0.34	-0.44	**-0.53**	**-0.47**	-0.37
Norway	-0.16	**-0.34**	-0.18	-0.24	-0.22
Portugal	-0.33	**-0.10**	**-0.21**	-0.34	-0.36
Singapore	-0.08	**-0.16**	**-0.15**	**-0.27**	**-0.14**
Slovenia	-0.17	***-0.06***	-0.12	-0.19	-0.18
Spain	-0.86	**-0.41**	**-0.66**	-0.83	**-0.99**
Sweden	-0.36	-0.51	-0.42	-0.37	-0.33
Switzerland	-0.28	-0.43	-0.45	-0.37	**-0.46**
Taiwan POC	-0.11	***0.01***	***-0.02***	-0.14	**-0.15**
United Kingdom	-0.29	**-0.40**	-0.42	-0.33	**-0.35**
United States	-0.30	-0.26	-0.33	-0.31	-0.32

Table 4 (continued). Okun Coefficients based on Actual Data and IMF Forecasts

Panel B. Middle income countries

Country	Actual	Apr[t-1]	Oct[t-1]	Apr[t]	Oct[t]
Argentina	-0.22	-0.25	-0.26	**-0.43**	**-0.41**
Barbados	-0.20	***0.05***	***0.09***	*-0.16*	-0.26
Chile	-0.29	-0.23	**-0.04**	-0.34	**-0.44**
Costa Rica	-0.25	-0.17	-0.20	-0.29	**-0.08**
Croatia	-0.31	-0.22	***-0.08***	-0.36	-0.27
Czech	-0.20	***0.01***	*-0.11*	-0.16	-0.29
Estonia	-0.29	***-0.08***	-0.22	-0.32	-0.26
Hungary	-0.14	-0.15	-0.11	-0.14	-0.16
Latvia	-0.29	-0.15	**-0.11**	-0.32	-0.22
Lithuania	-0.40	**-0.11**	**-0.16**	-0.35	-0.35
Malaysia	-0.06	**0.06**	***-0.02***	**-0.13**	**-0.22**
Mauritius	-0.36	**-0.10**	**-0.09**	**-0.09**	**-0.16**
Mexico	-0.18	***0.01***	***-0.02***	-0.13	**-0.10**
Panama	-0.23	***0.00***	***0.02***	-0.12	-0.11
Poland	-0.49	***-0.02***	***-0.04***	**-0.19**	***-0.11***
Romania	*-0.04*	*-0.04*	*0.04*	**-0.47**	**-0.37**
Russia	-0.15	***0.13***	**-0.07**	-0.18	-0.17
Slovakia	-0.29	**-0.14**	**-0.12**	-0.28	**-0.21**
South Africa	-0.32	-0.28	-0.38	-0.57	**-0.58**
Trinidad and Tob.	-0.09	*-0.01*	*0.02*	***0.04***	*-0.06*
Turkey	-0.15	-0.16	-0.14	**-0.24**	**-0.30**
Uruguay	-0.27	***0.14***	**-0.06**	**-0.09**	**-0.16**
Venezuela	-0.22	***-0.05***	***-0.04***	**-0.09**	**-0.11**

Table 4(continued). Okun Coefficients based on Actual Data and IMF Forecasts

Panel C. Low income countries

Country	Actual	Apr[t-1]	Oct[t-1]	Apr[t]	Oct[t]
Albania	-0.08	-0.19	*-0.07*	*0.01*	**-0.21**
Algeria	*-0.22*	-0.51	-0.35	-0.36	**-0.68**
Azerbaijan	-0.02	***0.00***	***0.00***	***0.00***	***0.00***
Belarus	-0.04	**-0.31**	***0.02***	*-0.05*	**0.08**
Brazil	-0.30	**0.09**	***-0.01***	**-0.10**	-0.20
Bulgaria	-0.16	***0.04***	*-0.09*	-0.12	-0.11
Cabo Verde	*-0.14*	*-0.09*	*-0.07*	*-0.01*	*-0.03*
China	*-0.01*	-0.04	*0.02*	*-0.01*	**-0.05**
Colombia	-0.37	***0.10***	***0.10***	***0.05***	-0.39
Egypt	-0.35	**-0.15**	-0.25	-0.20	-0.19
El Salvador	-0.28	***-0.03***	***-0.03***	-0.18	-0.36
Fiji	-0.08	-0.19	-0.20	**-0.29**	-0.08
Georgia	-0.13	-0.26	*-0.09*	-0.18	*-0.12*
Indonesia	-0.13	**0.83**	*-0.08*	**-0.24**	**-0.37**
Iran	*-0.12*	-0.17	-0.09	*-0.04*	-0.04
Jordan	*0.02*	-0.10	-0.07	*-0.05*	-0.06
Kazakhstan	-0.10	-0.08	-0.09	-0.06	-0.10
Macedonia	*0.01*	*-0.24*	*0.01*	-0.24	-0.12
Moldova	*-0.09*	*0.01*	**0.08**	*-0.01*	-0.08
Morocco	-0.18	-0.30	-0.14	**-0.45**	**-0.33**
Pakistan	-0.14	-0.11	***0.00***	***0.01***	***0.01***
Paraguay	-0.09	*-0.03*	-0.04	-0.04	-0.03
Peru	*0.03*	*0.06*	0.09	*0.04*	*0.00*
Philippines	*-0.06*	**-0.32**	*-0.06*	-0.25	*-0.07*
Sudan	*0.00*	**-0.04**	**-0.03**	*0.00*	*-0.02*
Thailand	-0.04	*0.02*	*0.02*	*-0.01*	*0.00*
Ukraine	-0.09	-0.32	*-0.09*	-0.21	**-0.21**
Vietnam	*-0.06*	*0.00*	-0.07	**-0.27**	**-0.19**

Table 5. Okun's Law Coefficients by Country Group

	Negative & Significant	Negative & Insignificant	Positive & Insignificant	Positive & Significant
	High income countries (33)			
Apr[t-1]	28	1	4	0
Oct[t-1]	29	2	2	0
Apr[t]	31	2	0	0
Oct[t]	32	1	0	0
Actual	31	2	0	0
	Middle income countries (23)			
Apr[t-1]	11	6	5	1
Oct[t-1]	12	7	4	0
Apr[t]	21	1	1	0
Oct[t]	20	3	0	0
Actual	22	1	0	0
	Low income countries (28)			
Apr[t-1]	15	6	5	2
Oct[t-1]	10	11	5	2
Apr[t]	15	9	4	0
Oct[t]	19	7	1	1
Actual	16	8	4	0

Note:

Table 6. Forecast Accuracy and Deviation from Okun's Law

	(1) All	(2) High	(3) Middle	(4) Low
Apr[t-1]				
Deviation	2.06*	3.92***	2.74*	-1.49
	(1.05)	(0.98)	(1.38)	(1.73)
Cons	1.95***	1.16***	2.21***	2.84***
	(0.21)	(0.14)	(0.33)	(0.43)
Obs	83	33	23	27
R-squared	0.04	0.26	0.12	0.02
Oct[t-1]				
Deviation	0.71	1.76***	3.75***	-3.21**
	(0.79)	(0.41)	(1.24)	(1.42)
Cons	1.89***	1.15***	1.65***	2.75***
	(0.17)	(0.14)	(0.25)	(0.30)
Obs	84	33	23	28
R-squared	0.01	0.15	0.21	0.07
Apr[t]				
Deviation	2.07***	2.45***	2.08*	-0.81
	(0.69)	(0.76)	(1.13)	(2.17)
Cons	1.49***	0.86***	1.66***	2.37***
	(0.15)	(0.14)	(0.26)	(0.41)
Obs	84	33	23	28
R-squared	0.05	0.21	0.08	0.00
Oct[t]				
Deviation	1.97*	1.37	1.27	2.25
	(1.11)	(1.87)	(1.62)	(1.50)
Cons	1.27***	0.72***	1.34***	1.95***
	(0.17)	(0.20)	(0.28)	(0.31)
Obs	84	33	23	28
R-squared	0.03	0.03	0.03	0.03

Note:

Table 7. Forecast Error in Unemployment and IMF Programs

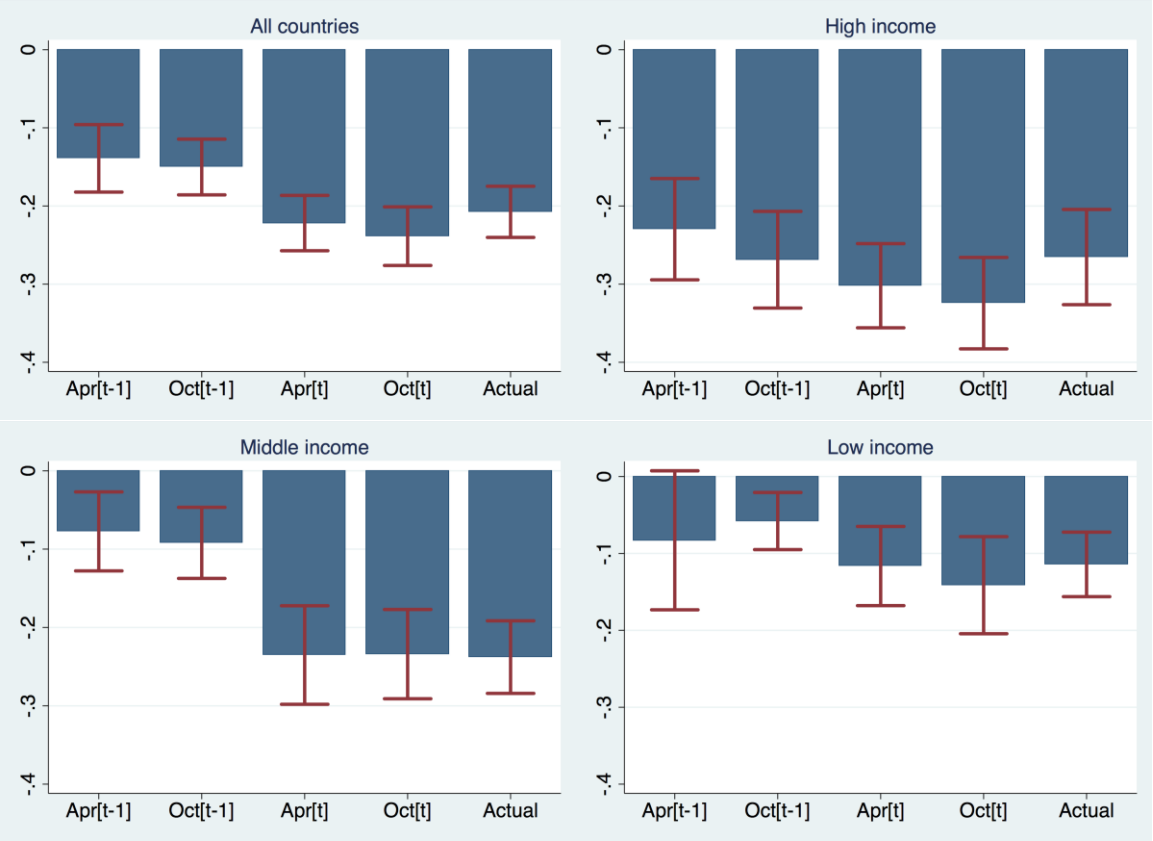
Panel A

Dep. Var.: FE_{ith}^{ur}	(1)	(2)	(3)	(4)
Indep. Var.	Apr[t-1]	Oct[t-1]	Apr[t]	Oct[t]
FE_{ith}^{gr}	-0.23***	-0.22***	-0.18***	-0.12***
	(0.01)	(0.01)	(0.01)	(0.02)
$FE_{ith}^{gr} * Prog_{i,t-h}$	0.07***	0.04**	0.07***	0.02
	(0.02)	(0.02)	(0.02)	(0.03)
$Prog_{i,t-h}$	0.77***	0.46***	0.31***	0.36***
	(0.11)	(0.11)	(0.10)	(0.10)
Constant	0.05	-0.17	-0.00	-0.06
	(0.04)	(0.40)	(0.35)	(0.32)
Num. of Obs.	1639	1639	1639	1639
R-Squared	0.25	0.22	0.22	0.19

Panel B

Dep. Var.: FE_{ith}^{dur}	(1)	(2)	(3)	(4)
Indep. Var.	Apr[t-1]	Oct[t-1]	Apr[t]	Oct[t]
FE_{ith}^{gr}	-0.18***	-0.17***	-0.16***	-0.12***
	(0.01)	(0.01)	(0.01)	(0.01)
$FE_{ith}^{gr} * Prog_{i,t-h}$	0.03**	0.03**	0.05***	0.01
	(0.02)	(0.02)	(0.01)	(0.02)
$Prog_{i,t-h}$	0.28***	0.12**	0.10	0.01
	(0.08)	(0.07)	(0.06)	(0.07)
Constant	0.05	-0.12	-0.02	-0.08
	(0.24)	(0.23)	(0.23)	(0.21)
Num. of Obs.	1639	1639	1639	1639
R-Squared	0.25	0.20	0.14	0.10

Figure 1. Summary of Okun Coefficients



Note:

Figure 2. Okun Coefficients based on Actual Data and IMF Forecasts

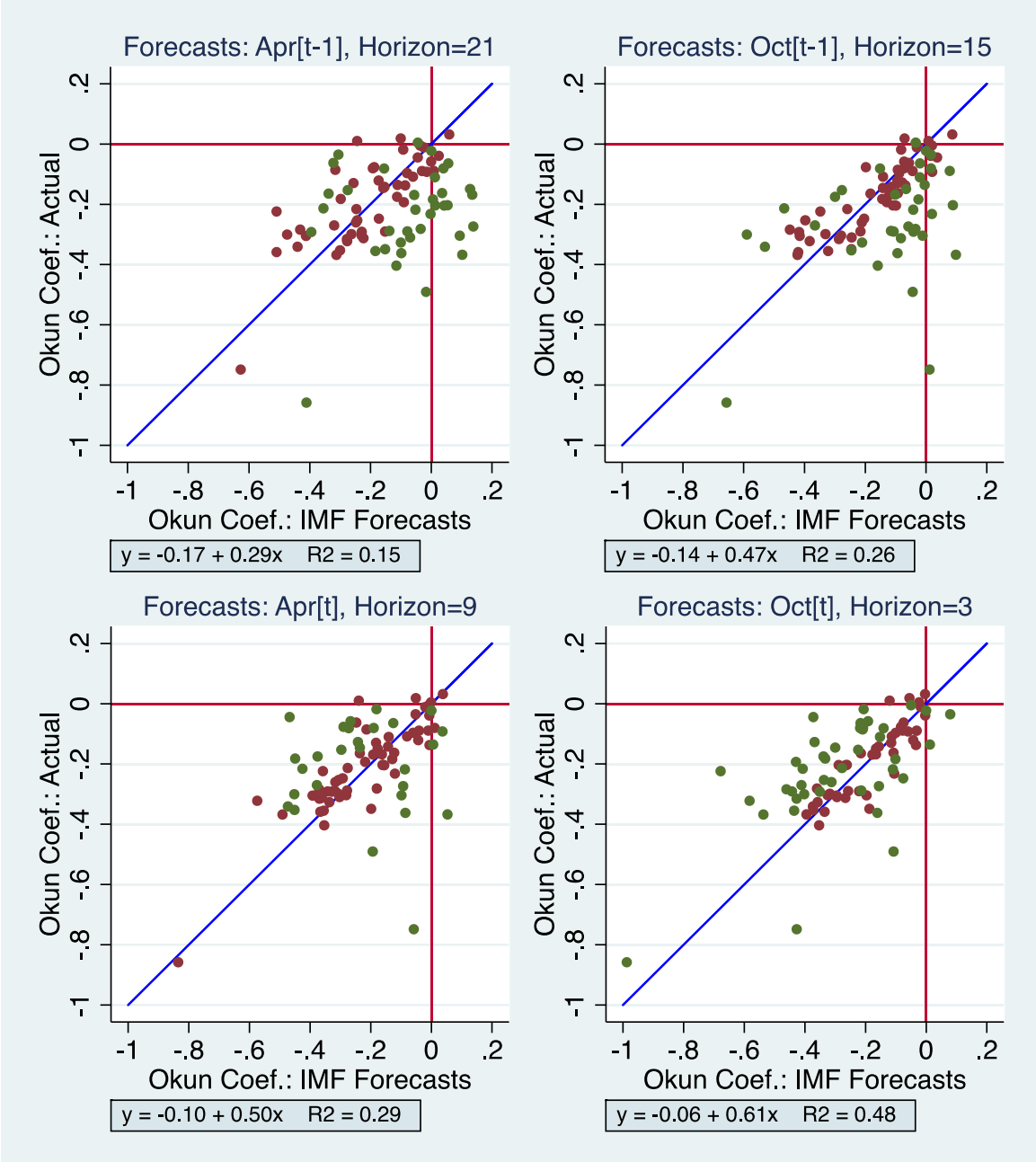


Figure 3. Okun Coefficients based on Actual Data and IMF Forecasts by Country Group

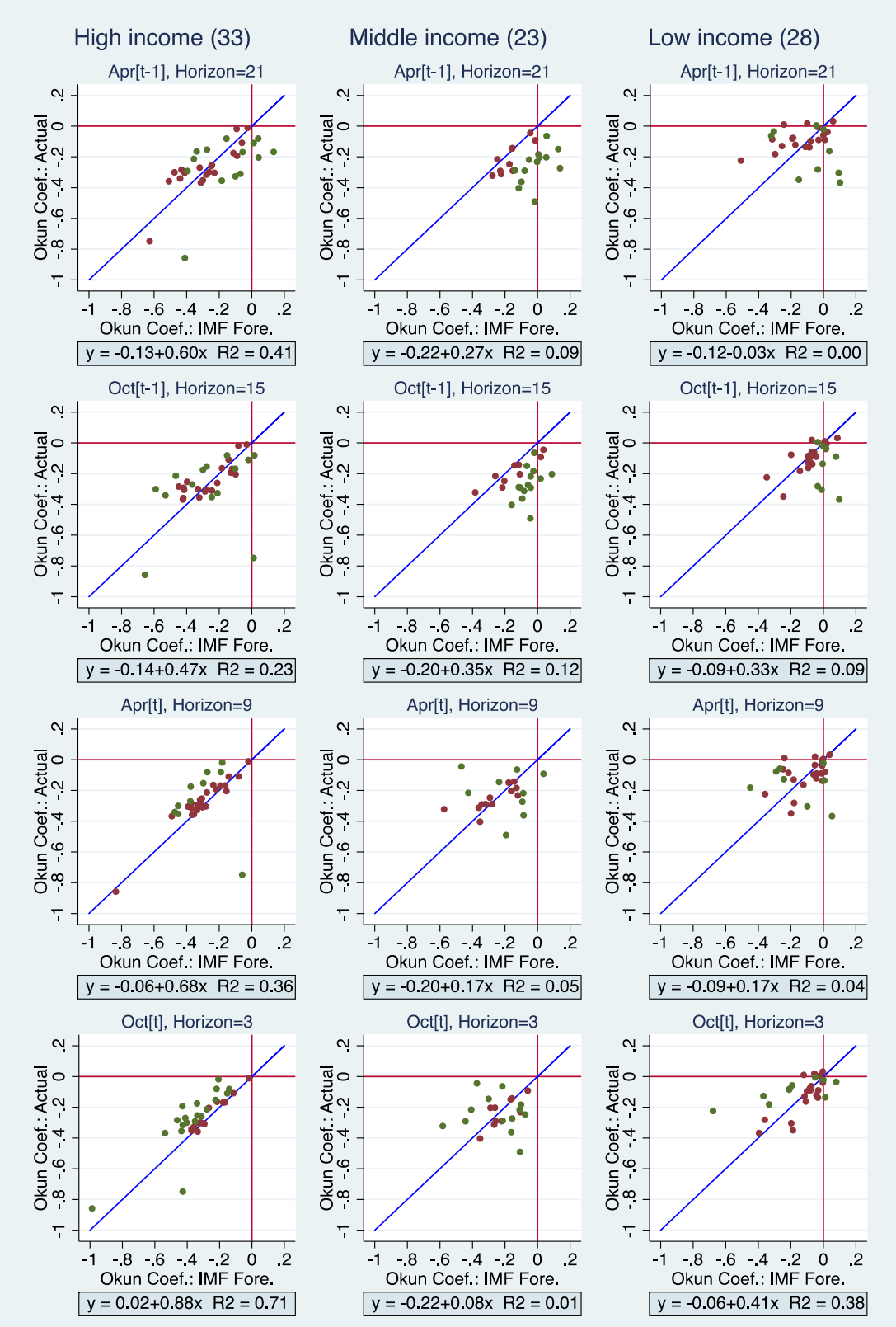


Figure 4(A) Okun's Law in Actual Data and IMF Forecasts: High-Income Countries

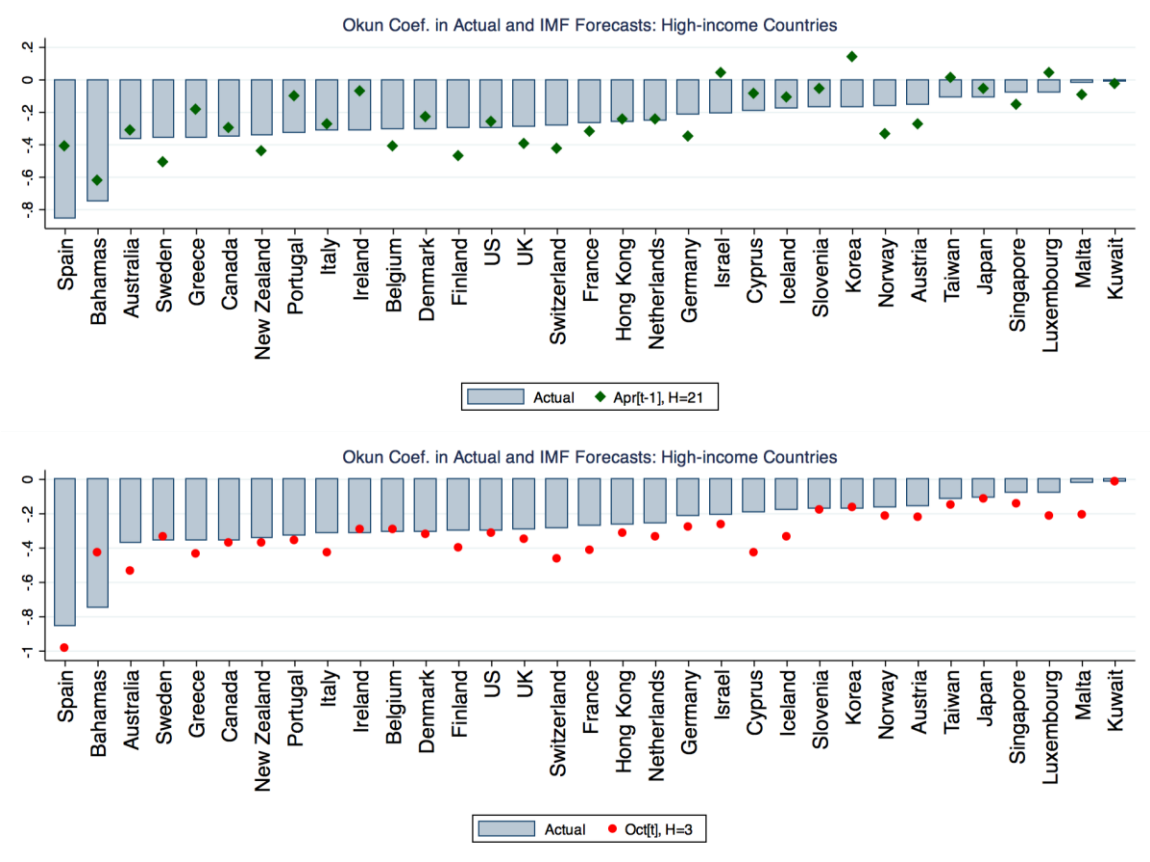


Figure 4(B) Okun's Law in Actual Data and IMF Forecasts: Middle-Income Countries

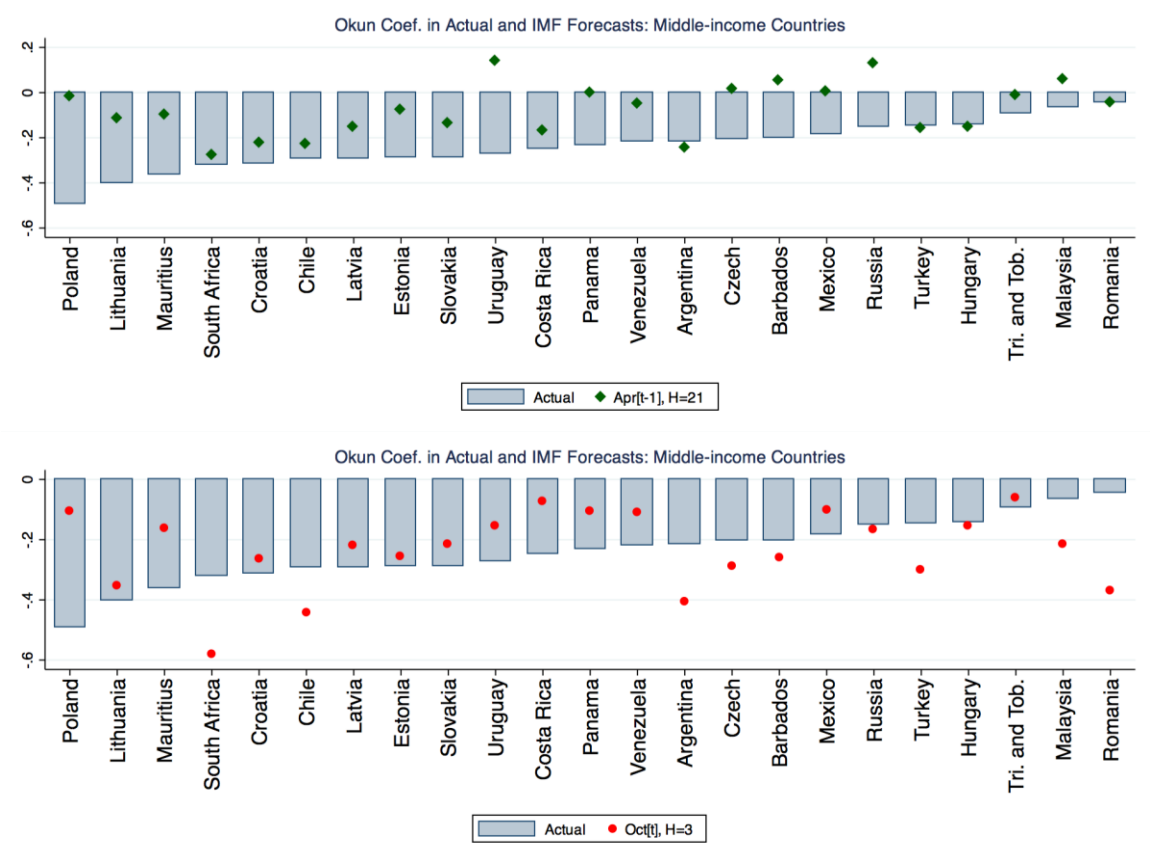


Figure 4(C) Okun's Law in Actual Data and IMF Forecasts: Low-Income Countries

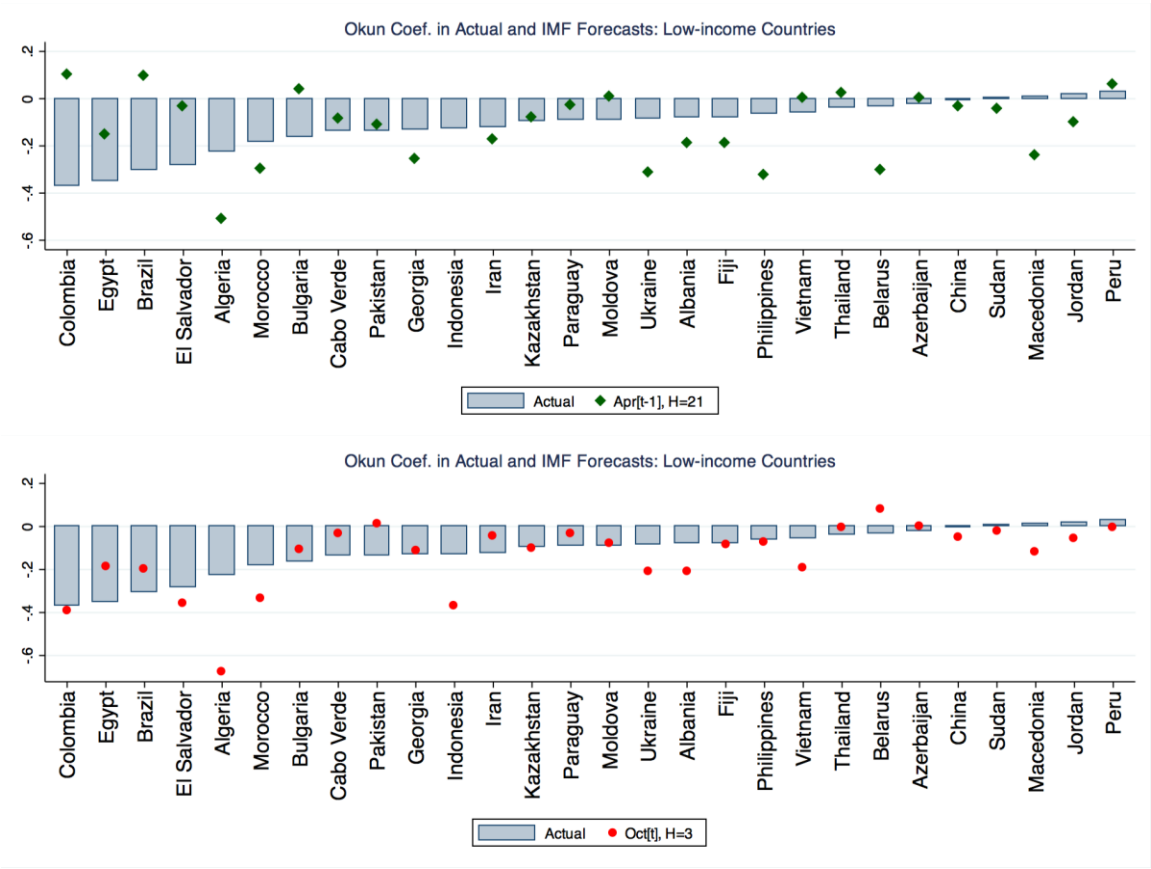


Figure 5. Forecast Accuracy and Deviations from Okun's Law

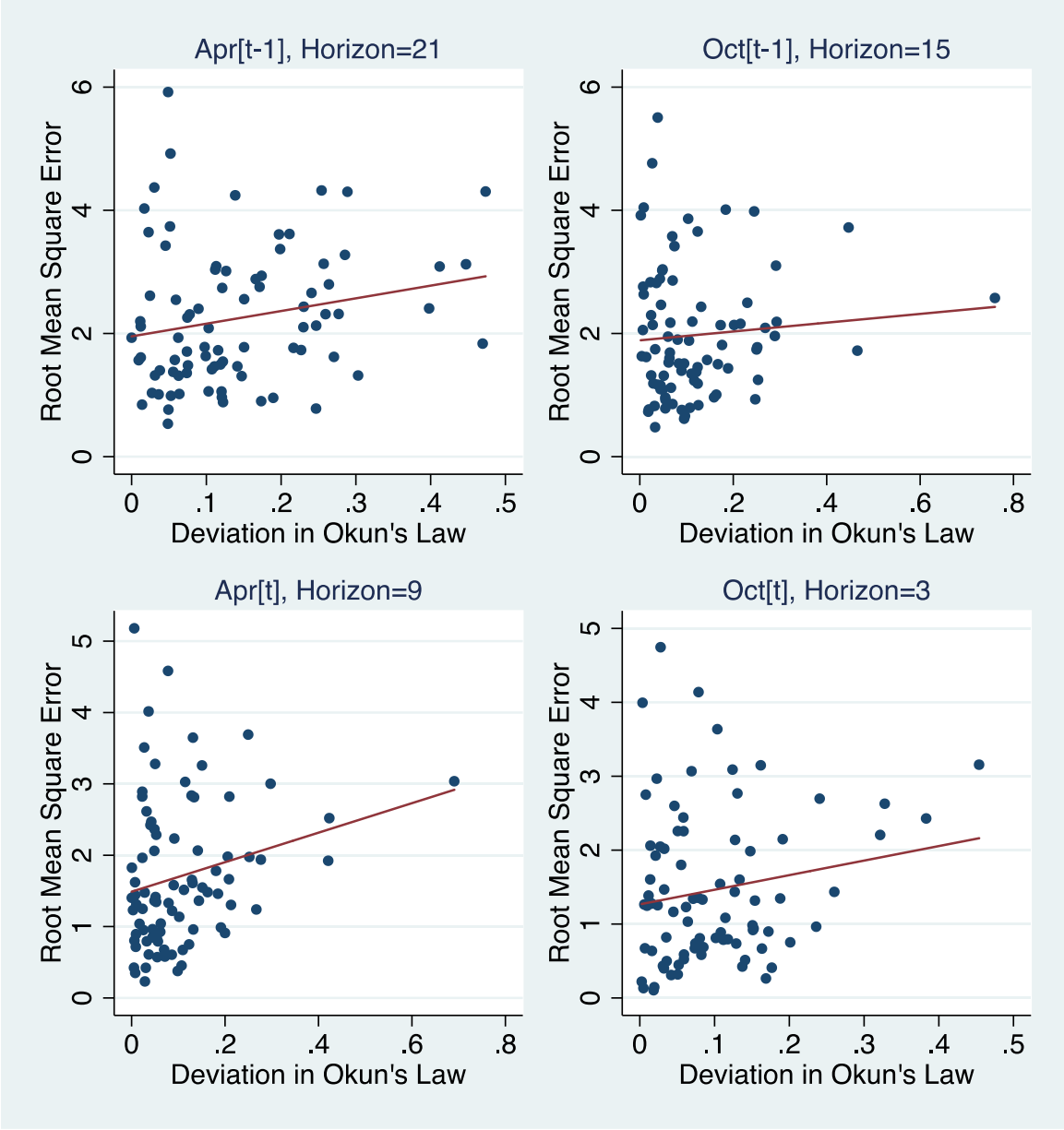


Figure 6. Forecast Accuracy and Deviations from Okun's Law by Country Group

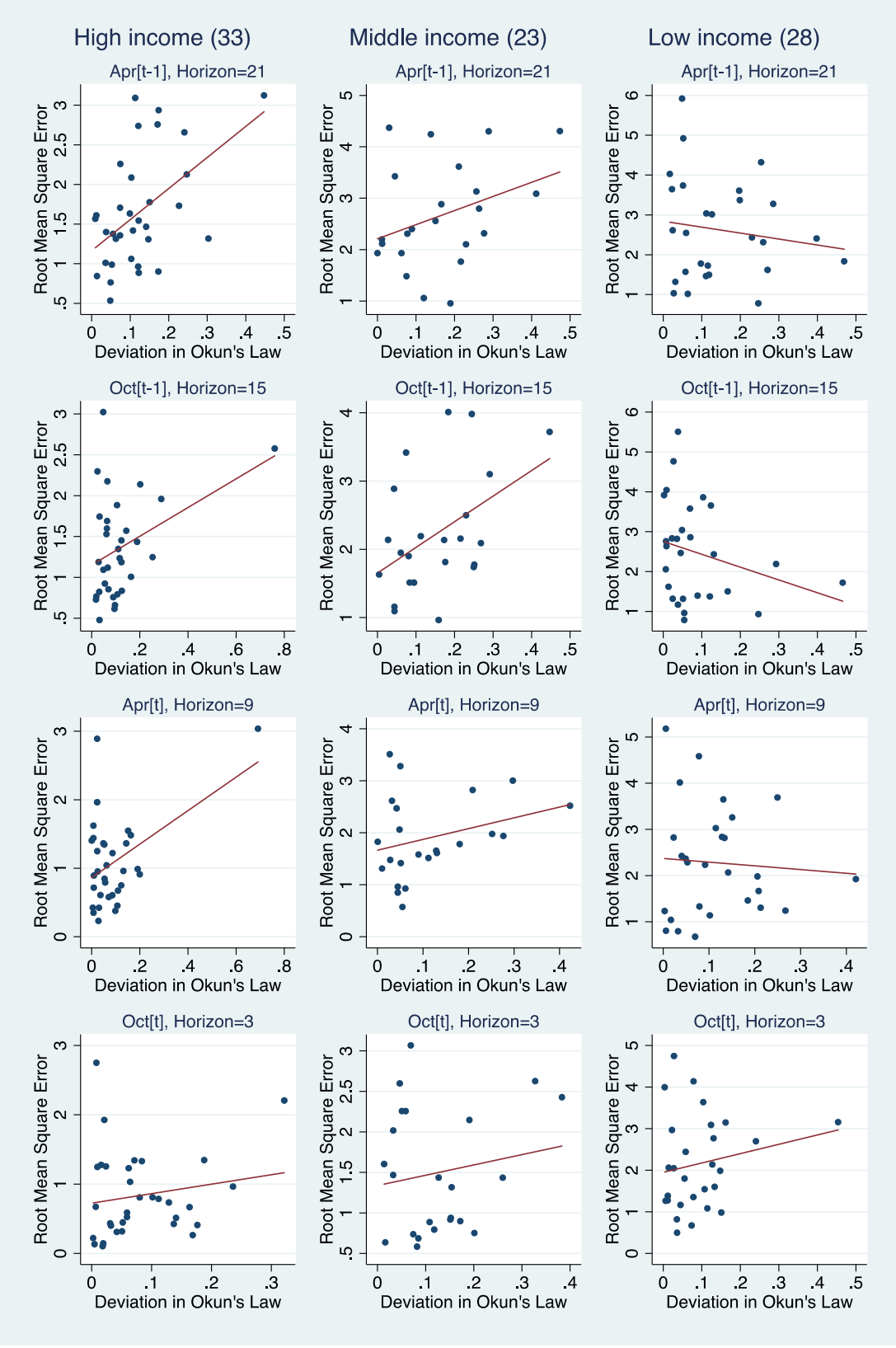


Figure 7. Forecasts Bias in IMF Programs

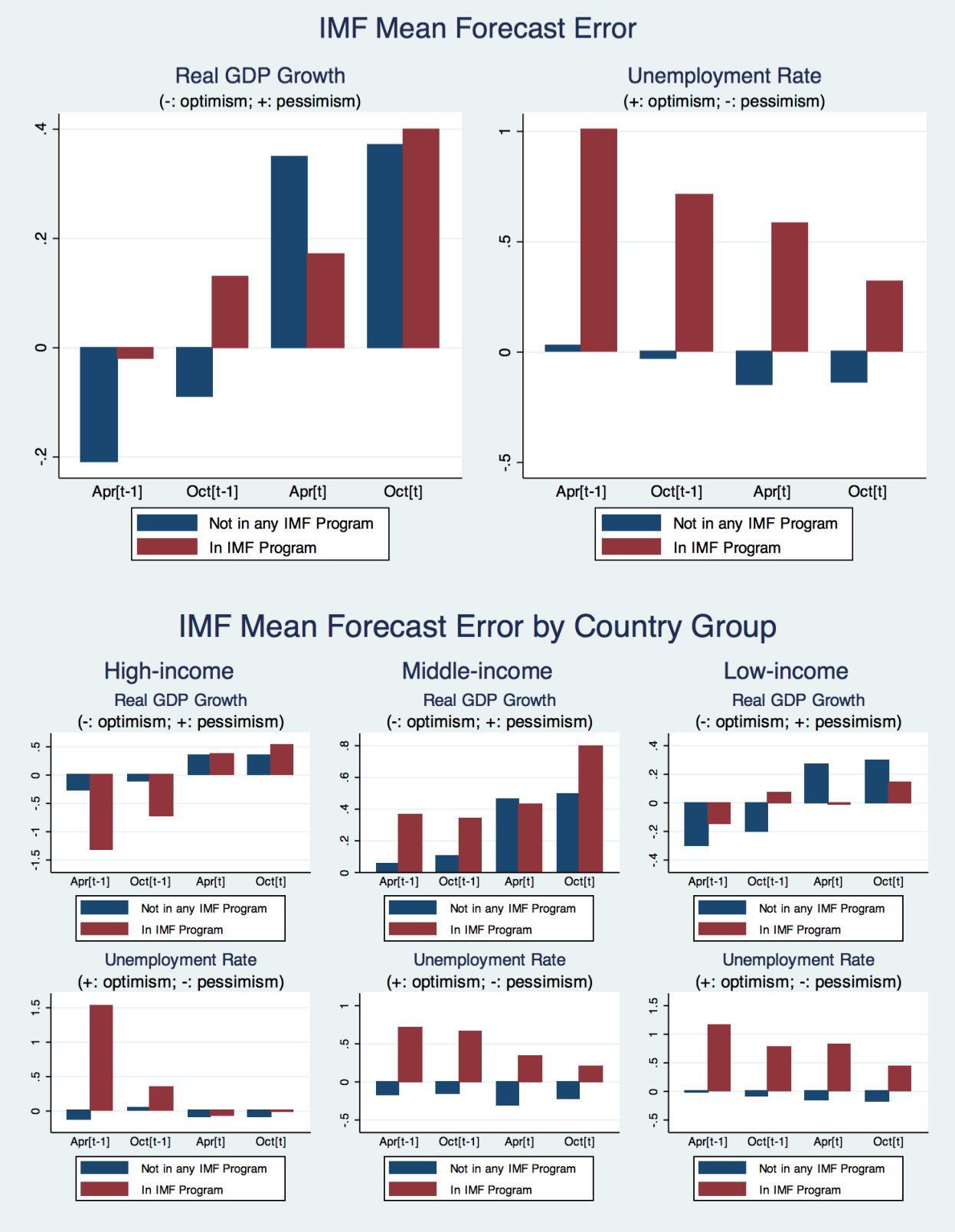


Figure 8. Deviation from Okun's Law in Program Cases

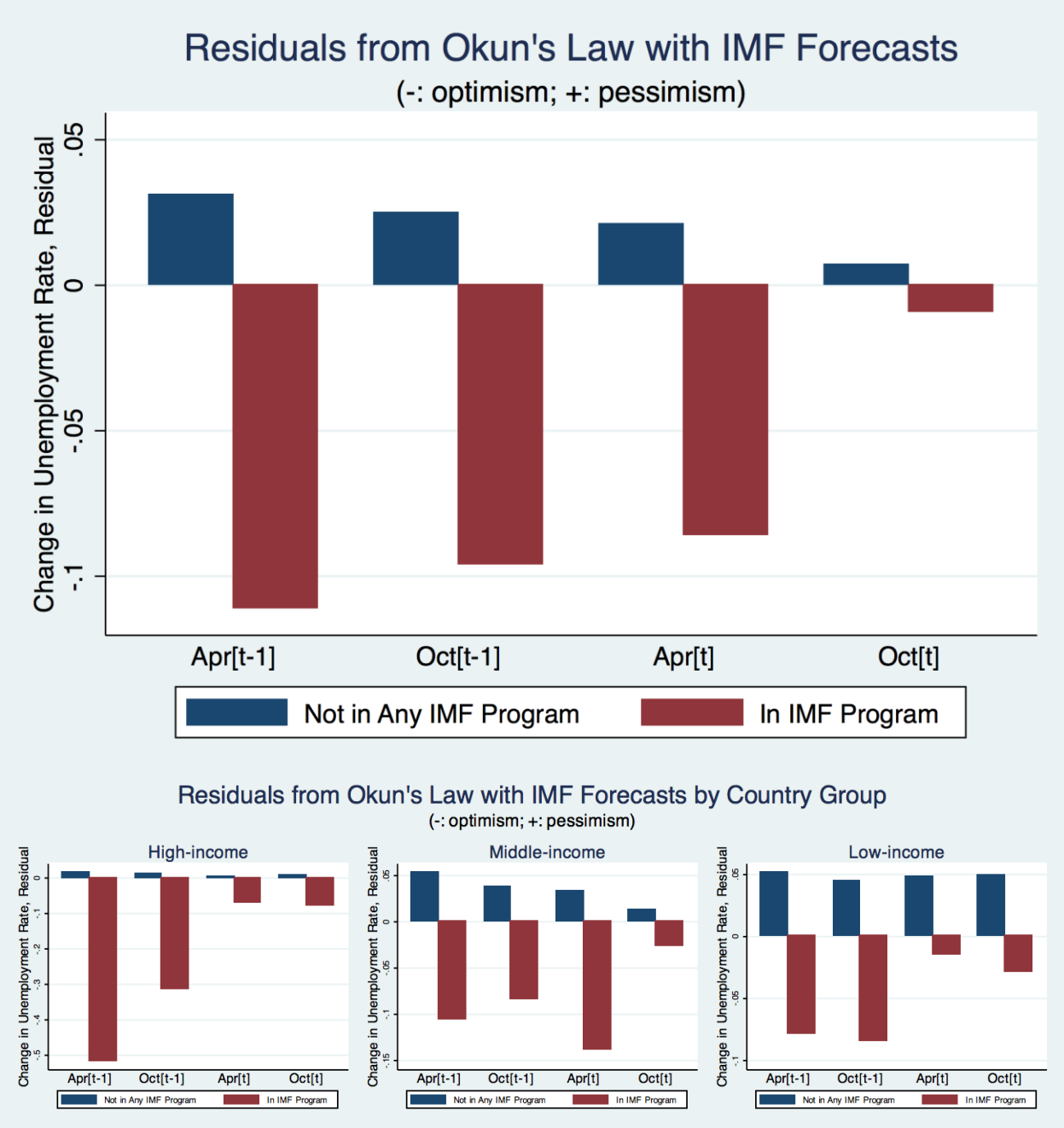


Table A1: Summary Statistics

		(1) All	(2) High	(3) Middle	(4) Low
Panel A. Unemployment					
Apr[t-1]	Mean	8.36	6.63	9.73	9.81
	Std.	5.20	3.78	4.91	6.41
Oct[t-1]	Mean	8.49	6.75	9.80	9.98
	Std.	5.29	3.89	4.89	6.56
Apr[t]	Mean	8.59	6.85	10.01	10.01
	Std.	5.32	3.99	4.90	6.52
Oct[t]	Mean	8.68	6.86	10.09	10.21
	Std.	5.47	4.03	5.03	6.74
Actual	Mean	8.65	6.80	9.98	10.29
	Std.	5.34	3.97	4.85	6.54
Panel B. Change in Unemployment					
Apr[t-1]	Mean	-0.25	-0.14	-0.38	-0.31
	Std.	0.67	0.51	0.67	0.85
Oct[t-1]	Mean	-0.18	-0.03	-0.38	-0.31
	Std.	0.67	0.57	0.67	0.77
Apr[t]	Mean	0.00	0.12	0.04	-0.22
	Std.	1.07	0.92	1.38	0.95
Oct[t]	Mean	0.06	0.13	0.11	-0.08
	Std.	1.27	1.05	1.67	1.16
Actual	Mean	-0.02	0.11	-0.10	-0.16
	Std.	1.33	1.10	1.69	1.28
Panel C. Real GDP Growth					
Apr[t-1]	Mean	3.84	2.92	4.13	5.01
	Std.	2.19	1.51	1.74	2.73
Oct[t-1]	Mean	3.67	2.73	3.92	4.90
	Std.	2.22	1.59	1.93	2.59
Apr[t]	Mean	3.19	2.25	3.34	4.48
	Std.	2.92	2.30	3.09	3.10
Oct[t]	Mean	3.10	2.23	3.18	4.34
	Std.	3.38	2.50	3.90	3.65
Actual	Mean	3.54	2.59	3.77	4.77
	Std.	4.22	3.04	4.36	5.19
Panel D. Number of Cases in IMF Program or Not					
In IMF Program		389	23	144	222
Not in IMF Program		1384	765	313	306

Bibliography

Ball, L., Furceri, D. Leigh, D. and Loungani, P. (2016), Does One Law Fit All? Okun's Law in Advanced and Developing Economies, working paper.

Ball, L., Jalles, J. T., & Loungani, P. (2015). Do forecasters believe in Okun's Law? An assessment of unemployment and output forecasts. *International Journal of Forecasting*, *31*(1), 176-184.

Ball, L., Leigh, D. and Loungani, P. Okun's Law: fit at fifty, Journal of Money, Credit and Banking, forthcoming.

Barnes, M. Gumbau-Brisa, F., & Olivei, G. (2013), Do Real-Time Okun's Law Errors Predict GDP Data Revisions? Federal Reserve Bank of Boston, Working Paper 13-3.

Baqir, R., Ramcharan, R., & Sahay, R. (2005). IMF programs and growth: is optimism defensible?. *IMF Staff Papers*, 260-286.

Blanchard, O. and Fischer, S. (1989). *Lectures on Macroeconomics*. MIT Press.

Blinder, A. (1997), Is there a core of practical macroeconomics that we should all believe? *American Economic Review*, 87, 240-43.

Christofides, C., Eicher T., Kuenzel D. and Papageorgiou P. (2017), Forecasts in Times of Crises, working paper.

Fendel, R., Lis, E. and Rülke, J. (2011). Do professional forecasters believe in the Phillips curve? evidence from the G7 countries. *Journal of Forecasting*, *30*(2), 268-287.

Freeman, D. (2001), Panel tests of Okun's Law for ten industrial countries", *Economic Inquiry*, 39, 511-23.

Lee, J. (2000), "The robustness of Okun's Law: evidence from OECD countries," *Journal of Macroeconomics*, 22, 331-56.

Mankiw, N. G. (2012). Macroeconomics 5th ed. Worth Publishers.

Mitchell, K., and Pearce, D. (2010). Do Wall Street economists believe in Okun's Law and the Taylor Rule? *Journal of Economics and Finance*, *34*(2), 196-217.

Moosa, I. (1997), "A cross-country comparison of Okun's coefficient", *Journal of Comparative Economics*, 24, 335-56.

Okun, A. (1962): "Potential GNP: its measurement and significance", Proceedings of the Business and Economics Statistics Section, American Statistical Association.

Paldam, M. (1987), How much does one percent growth change the unemployment rate? A study of 17 OECD countries, 1948-1985, *European Economic Review*, 31, 306-13.

Pierdzioch, C., Rülke, J. and Stadtmann, G. (2011), "Do professional economists' forecasts reflect Okun's Law? Some evidence for the G7 countries", *Applied Economics*, 43, 1365-73.

Romer, D. (2012). *Advanced Macroeconomics*, 4th edition, McGraw-Hill.

Rülke, J. (2012), Do professional forecasters apply the Phillips curve and Okun's law? Evidence from six Asian-Pacific countries. *Japan and the World Economy*, *24*(4), 317-324.

Silvapulle, P., Moosa, I. and Silvapulle, M. (2004). Asymmetry in Okun's law. *Canadian Journal of Economics*, 37(2), 353-374.

Sinclair, T., Stekler H. and Carnow W. (2012), A new approach for evaluating economic forecasts, IIEP-WP-2012-02.

Sögner, L., & Stiassny, A. (2002). An analysis on the structural stability of Okun's law--a cross-country study. *Applied Economics*, *34*(14), 1775-1787.

Tillmann,, P. (2010), "Do FOMC members believe in the Okun's Law?", *Economic Bulletin*, 30(3), 2398-2404.