Identifying the Characteristics of IMF Macroeconomic Forecasts[*]

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Abstract

A time-series cross-sectional analysis of the IMF's macroeconomic forecasts during 1994-2003 suggests that forecast performance differed across regions: optimism in Africa and Latin America, pessimism in industrial countries and the Middle East, and lack of systematic bias in emerging Asia and transition countries. Further analysis shows that the optimistic bias was related to the presence of an IMF lending program in Africa and errors in forecasting US interest rates in Latin America. Unanticipated changes in the monetary policy of the largest economy and oil prices had statistically significant impact not only on the forecasts for Latin America, but also for other regions, though in different directions.

JEL classification codes: E37, F37, F53

Keywords: IMF forecasts, forecasting bias, macroeconomic forecasts

I. Introduction

This paper examines the characteristics of the macroeconomic forecasts produced by the International Monetary Fund (IMF). In particular, it tests the unbiasedness and efficiency of IMF macroeconomic forecasts for six regions and to see whether a bias, if any, was systematically related to the presence of an IMF program or forecast errors on key global variables, such as US interest rates. The paper attempts to add to the literature by identifying the sources of bias in IMF forecasts; it applies several alternative methodologies, with appropriate robustness checks. The data used for the study come from the 1994-2003 period, when the IMF maintained a relatively large number of lending arrangements with member countries at different income levels.[1]

* The authors have benefited from the useful comments of Professor Michael Artis and Dr. Philip Hubbard. However, we remain solely responsible for the views expressed in the paper as well as for any remaining errors.

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1 Against the plentiful supply of international capital inflows into emerging markets, and possibly with the stigma of IMF financing, the number of new non-concessional lending arrangements declined drastically from 12 in 2003 (end-April) to 5 in 2004 (and further to 2 in 2007). It was not until the fall of 2008, following the onset of the global financial crisis, that the number of non-concessional arrangements picked up again.

The IMF's macroeconomic forecasts are unique in that they are produced by an international financial institution with near-universal membership. This means that they reflect both the IMF's knowledge of individual economies (which it monitors on a regular basis) and its understanding of the interlinkages between them, which may constrain the behavior of economic variables in individual countries. The IMF's knowledge of economic developments and prospects in individual countries may not be as intimate as that of national authorities or local forecasters, but it has the distinct advantage of understanding how they may interact with each other across borders. Because the forecasts for all countries are produced simultaneously, moreover, we expect them to satisfy the general equilibrium constraints that are binding for the world economy, at least to a greater extent than the comparable forecasts produced by other institutions. As such, IMF macroeconomic forecasts receive considerable attention when they are released and may even serve as a benchmark for other forecasters in some cases.[2]

It therefore comes as no surprise that the accuracy of IMF macroeconomic forecasts has been much discussed in the literature. For example, a number of previous studies, including Barrionuevo (1993) and Artis (1997), noted that the IMF's current-year growth and inflation forecasts for G7 countries were optimistic in the 1970s but the forecasts became pessimistic in the 1980s. For the 1990s, Timmermann (2006) found that the direction of bias was different across the G7 countries but the bias was statistically insignificant; Blix et al (2001) showed that the forecast for industrial countries were pessimistic, though the bias was numerically small.[3]

As to the IMF's forecasts for developing countries, most previous studies have almost always found them to be optimistically biased. Artis (1997) and GAO (2003) attributed this to the presence of an IMF lending program, but the robustness of this result has been disputed (see Musso and Phillips, 2002; Ghosh et al., 2005; Timmermann, 2006). Previous studies have generally attempted to identify the source of bias by making a distinction between countries with IMF programs and those without, but the presence of an IMF program may be proxying for the influence of other factors that necessitate financial assistance from the IMF.

In identifying the source of bias in the macroeconomic forecasts for IMF program countries, this paper employs a more discriminating approach by making a distinction not only between program and nonprogram countries but also between program and nonprogram years. In addition, the paper also seeks to analyze the impact of errors in forecasting global variables on the accuracy of IMF macroeconomic forecasts for individual countries, an approach similar to the one used by Artis (1988) for G7 countries. By controlling for the IMF's errors in forecasting oil prices and the exchange rate and interest rates of the largest economy, we attempt to measure the extent to which the forecast errors on global variables explain the errors in the IMF's macroeconomic forecasts for a larger group of countries.

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[2] According to data supplied to the authors by the IMF's External Relations Department, during 2005, there were about 3500 press references world-wide to the semiannual *World Economic Outlook* report. It is believed that many of these references were related to the macroeconomic forecasts released therein.

[3] Blix et al (2001) also show that pessimism for industrial countries was a characteristic of Consensus forecasts as well.

The remainder of the paper is organized as follows. Section II explains the data and methodology used in this study. Section III presents the empirical results on the unbiasedness and efficiency of IMF forecasts. Section IV attempts to identify the sources of forecast errors. Section V presents concluding remarks. Finally, Appendix I lists the sample countries, grouped by region or country group, and Appendix II presents a series of tables reporting the corresponding results from bootstrapped data.

II. Data and Methodology

In this study, we restrict our attention to the IMF's real GDP growth and inflation forecasts for 1994-2003, a period when the IMF maintained a relatively large number of lending arrangements with member countries at different income levels. We use the April issues of the *World Economic Outlook* (WEO) for the IMF's current-year forecasts, and the September issues for its one year-ahead forecasts. We use the April 2004 issue to obtain the realized time-series of growth and inflation for IMF member countries for the relevant past years, and likewise the September 2004 issue for the realized time-series of the global variables.[4] In order to eliminate outliers and secure a more balanced dataset, we select a sample of 109 countries with an annual GDP of $5 billion or more (see Appendix I). Given our focus on the IMF's overall forecast performance, we present our results by region or country group, though we also look at individual countries to make additional inferences.[5]

The regression analysis consists of estimating the following two models:[6]

Test of unbiasedness: $F_{it} - R_{it} = e_{it} = \beta_0 + \mu_{it}$, with $H_0 : \beta_0 = 0$ (1)

Test of efficiency: $R_{it} = \beta_0 + \beta_1 F_{it} + \mu_{it}$, with $H_0 : \beta_0 = 0$ and $\beta_1 = 1$ (2)

where F is a forecast value, R is a realized value, e is a forecast error, β_0 and β_1 are coefficients to be estimated, μ is a random error term, i is a country subscript, and t is a time subscript.

In order to assess the possible roles of an IMF lending program and forecast errors on the global variables in generating systematic forecast errors, we also estimate the following relationships:

$$e_{it} = \alpha + \beta_1 USEXR_{it} + \beta_2 USINT_{it} + \beta_3 Petroleum_{it} + \beta_4 Nonfuel_{it} + \mu_{it} , \quad (3)$$

$$e_{it} = \beta_1 Nonprogram_i + \beta_2 PRGF_i + \beta_3 NonPRGF_i + \mu_{it} , \quad (4)$$

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4 Some studies have used the realized numbers obtained from the next available publication for each year. Our preliminary analysis suggests that this choice of realized numbers does not materially change the results of the paper.

5 The regions and country groups are as defined by the WEO, except for transition countries (for which Central and Eastern Europe and the Commonwealth of Independent States are combined).

6 These tests are widely used in the literature and discussed by Barrionuevo (1993), Artis (1997), and Gavin and Mandal (2003).

$$e_{it} = \beta_1 program_{it} + \beta_2 nonprogram_{it} + \mu_{it} \,, \tag{5}$$

where *program* and *nonprogram* (or *Nonprogram*) are dummy variables for the presence and absence of any IMF lending program,[7] *PRGF* is a dummy variable for a Poverty Reduction and Growth Facility (PRGF) program, the IMF's concessional lending window for low-income countries,[8] and *NonPRGF* is a dummy variable for the IMF's other lending instruments; *USEXR* and *USINT* are forecast errors on the real effective appreciation of the US dollar and the real rate of return on US dollar deposits, respectively; *Petroleum* and *Nonfuel* are forecast errors on the changes in oil and commodity prices;[9] and β_k (k=1, 4) is a coefficient to be estimated. The forecast errors for the global variables are expressed as percentage changes, except for the forecast error for the real interest rate (which is assumed to be stationary).[10]

The main problem in applying regression analysis to IMF forecasts comes from the short sample period. To address this problem, we employ time-series cross-sectional regression and check the robustness of the results by bootstrapping the sample 1000 times. In addition, we use three alternative panel-data methods, namely, OLS Prais-Winsten, panel-data GLS, and Generalized Estimating Equations (GEE), all of which are considered to produce more reliable estimates when the sample has a fixed *T* and a limited number of countries. The results of all three methods, both from the original and bootstrapped data, are found to yield broadly the same conclusions. The results obtained from the bootstrapped data are reported in Appendix II.

Another potential problem concerns parameter restrictions, because earlier studies of IMF forecasts have suggested the possibility that parameter values may systematically differ across countries. Because we are more interested in the overall performance of IMF forecasts, rather than their performance in individual countries, a GLS panel-data estimator may be more appropriate for our purpose. The GLS panel-data estimator yields a weighted average of the within-group and between-group estimators, by increasing the number of observations and adjusting the forecast errors by standard deviations (which can be thought of as a proxy for forecasting difficulty).

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7 It should be noted that the dummies in equation (4) are country-specific, while those in equation (5) are both country and time-specific. For a country that has never had an IMF program, the value of the *Nonprogram* dummy in equation (4) is set equal to 1 for all years, but it turns out that the sample used for testing equation (5) contains no such country. In this sense, the nonprogram dummies in these two equations are not exactly the same thing. It is for this reason that the notation for the nonprogram dummy is capitalized in equation (4) but not in equation (5).

8 In 2010, the PRGF was replaced by a new concessional lending facility with more flexible terms called the Extended Credit Facility (ECF).

9 As given by the IMF's index of commodity prices.

10 The stationarity of forecast errors for the real interest rate could be tested formally by a panel cointegration test, which normally requires a minimum of 20 observations to yield robust results. Unfortunately, our sample is limited to 10 observations per country.

III. Tests of Unbiasedness and Efficiency

Figures 1 and 2 depict, for the period 1991-2003, the time-series of economic growth and inflation, respectively, for six regions or country groups (industrial countries, emerging Asia, Latin America, transition countries, the Middle East, and Africa), along with the IMF's current-year forecast errors for each of these variables. At first glance, we observe that the magnitude of the forecast errors generally declined over time,[11] as the global economic environment became more stable. This is particularly the case for the inflation forecasts: the forecast errors declined sharply in Latin America, transition countries, the Middle East and Africa, along with an evident secular decline in the rate of inflation from the first half of the 1990s. Another observable pattern is a seemingly negative correlation between the realized values and the forecast errors. This was particularly evident in emerging Asia and transition countries, for both growth and inflation. In part, the negative correlation may be a statistical artifact that reflects the definition of a forecast error, but it could also reflect the cyclical factor related to a consistent failure to forecast the turning points accurately.

These figures seem to indicate that the forecasts were systematically different for different regions or country groups. For example, the growth forecasts for industrial countries may have been pessimistic as the forecast errors are found mostly in the negative range, whereas the forecasts for Africa were clearly optimistic in that the forecast errors were consistently positive throughout the period. A similar tendency is observed for Latin America, where the forecast errors were mostly in the positive range. For inflation, the forecasts for Latin America and transition countries were optimistic in the early 1990s and the mid-1990s, respectively, when the realized values consistently exceeded the forecast values (with the forecast errors consistently in the negative range). The pattern for emerging Asia was somewhat different, displaying no consistent bias of one type or the other: the forecast errors for both growth and inflation took both negative and positive values.

Formal statistical tests confirm these casual observations (Table 1). First, for industrial countries, the coefficient (β_0) for current-year forecast errors estimated from running equation (1) is negative and statistically significant for growth[12] and positive and statistically significant for inflation, indicating that the forecasts were pessimistic. The forecast errors for inflation, however, were numerically very small. Second, for Africa, the estimated coefficient was positive and statistically significant for growth and negative and generally significant for inflation, indicating that the forecasts were optimistic. To the extent that many African economies depend on commodity exports, forecasting growth can be a particularly difficult exercise. But the optimistic bias in growth forecasts was significant in the GLS estimation, even after adjusting for the variance of the forecast errors (as a proxy for forecasting difficulty).[13]

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[11] When we look at the forecast errors for individual countries, we find that they were often large, even for industrial countries. For example, the forecast errors for growth in the United States ranged between -1.93 percent and 0.93 percent.

[12] There was a considerable variation across countries. For example, the underprediction of growth was particularly noticeable for the United States and the United Kingdom, whereas growth was overpredicted for Germany and Italy.

[13] When the data for individual countries are considered, the forecasts for a handful of African countries were on the pessimistic side, possibly reflecting political instability in these countries.

Figure 1. Economic Growth and IMF Current-Year Forecast Errors for Selected Regions, 1991–2003 (In percent per year)

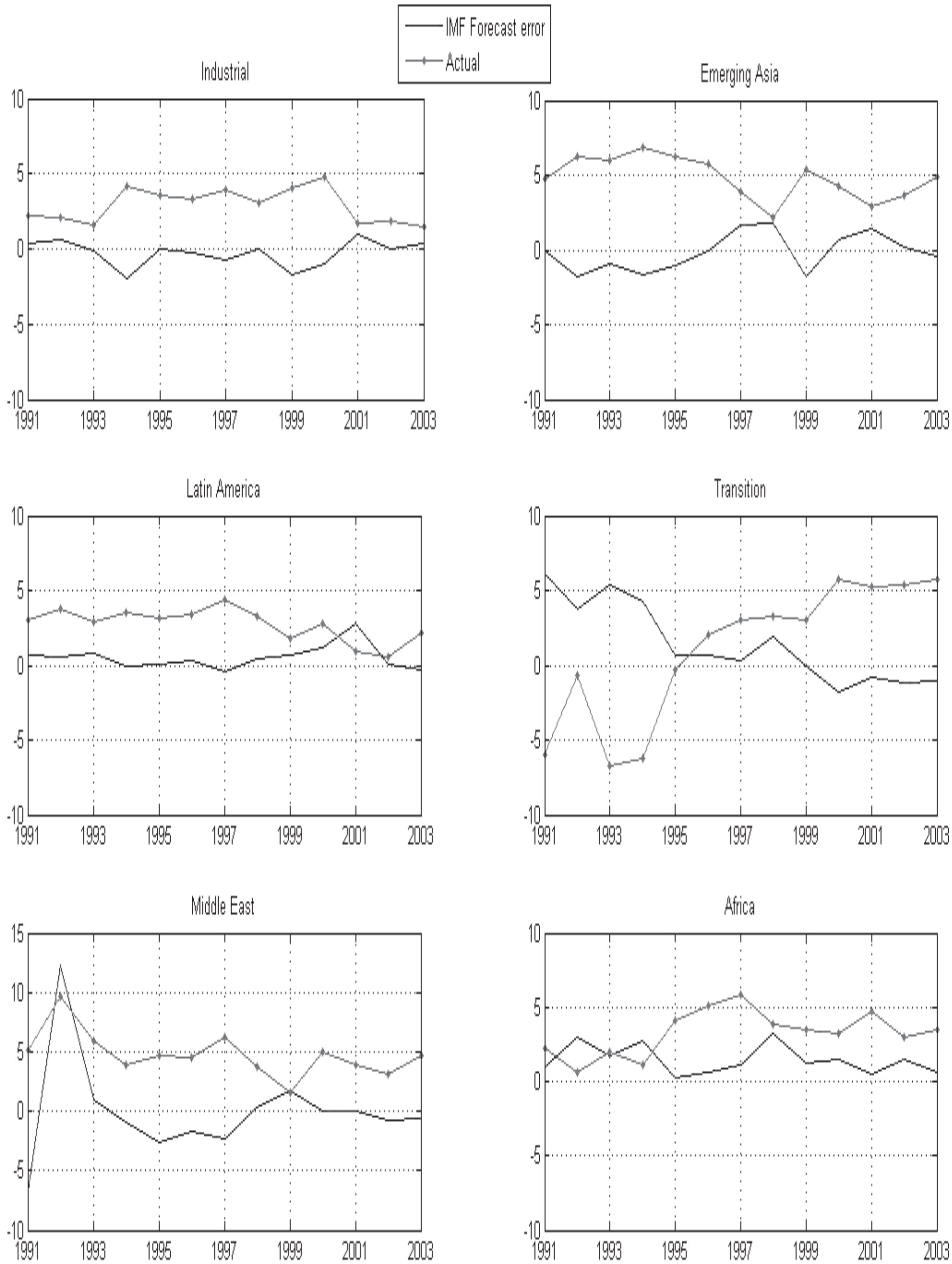

Figure 2. Inflation and IMF Current-Year Forecast Errors for Selected Regions, 1991–2003 (In percent per year)

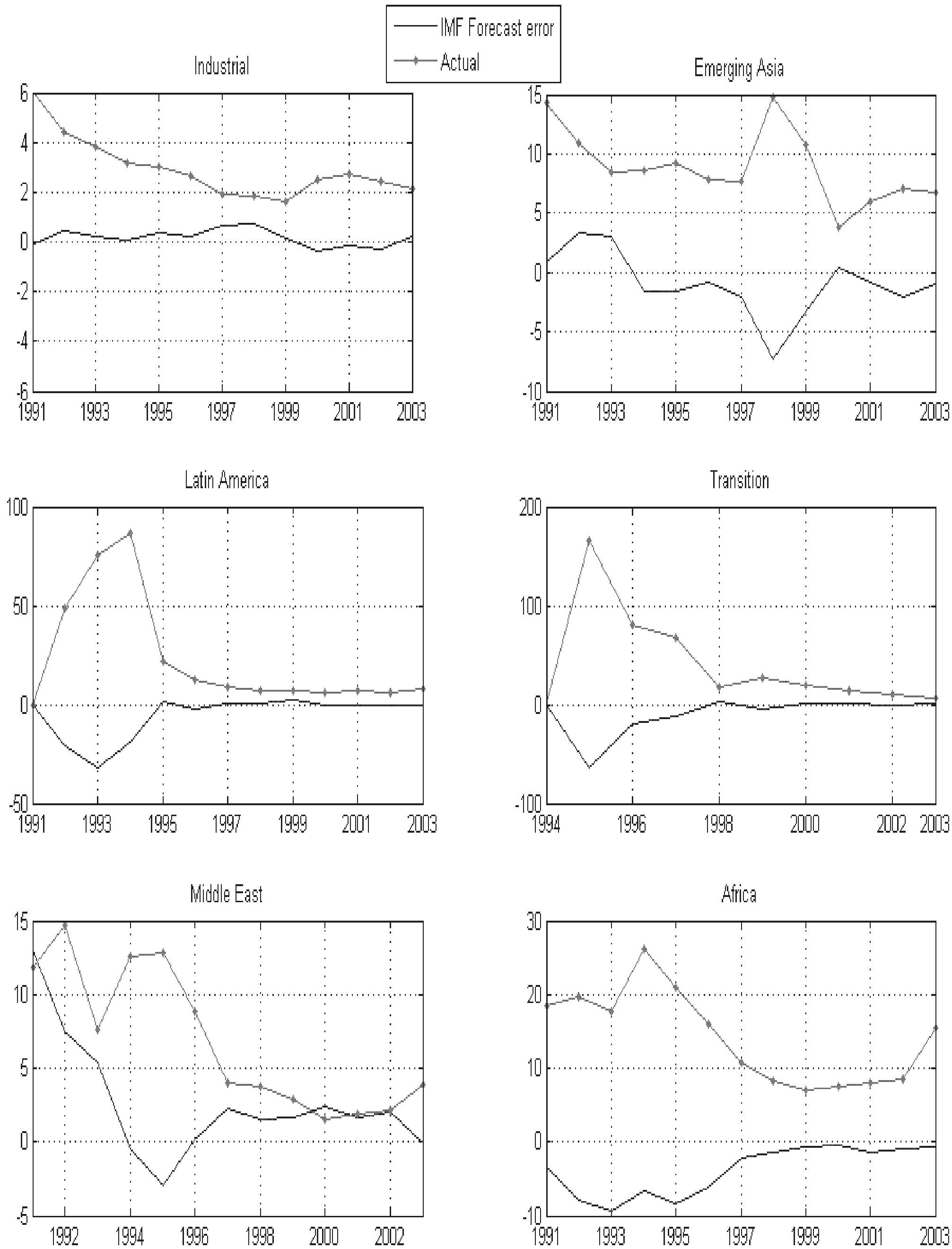

Table 1. Testing the Unbiasedness of IMF Current-Year Forecasts, 1994–2003[1]

A. Growth

		OLS[2]	GLS[3]	OLS P-W[3]	GEE[4]
Industrial	Constant (β_0)	-0.41	-0.36	-0.45	-0.41
		(0.10)	(0.07)	(0.11)	(0.10)
Emerging Asia	Constant (β_0)	0.02	0.00	0.22	-0.02
		(0.23)	(0.17)	(0.27)	(0.26)
Latin America	Constant (β_0)	0.39	0.37	0.33	0.38
		(0.19)	(0.13)	(0.21)	(0.15)
Transition	Constant (β_0)	0.05	-0.24	-0.03	0.17
		(0.34)	(0.26)	(0.40)	(0.36)
Middle East	Constant (β_0)	-0.67	-0.75	-0.89	-0.67
		(0.30)	(0.19)	(0.31)	(0.28)
Africa	Constant (β_0)	0.66	0.65	0.82	0.65
		(0.19)	(0.14)	(0.24)	(0.24)

B. Inflation

		OLS[2]	GLS[3]	OLS P-W[3]	GEE[4]
Industrial	Constant (β_0)	0.17	0.13	0.17	0.17
		(0.06)	(0.04)	(0.08)	(0.06)
Emerging Asia	Constant (β_0)	-1.07	-0.74	-1.26	-1.08
		(0.59)	(0.28)	(0.55)	(0.91)
Latin America	Constant (β_0)	0.54	-0.05	-3.23	-0.06
		(0.74)	(0.20)	(2.12)	(1.17)
Transition	Constant (β_0)	-8.91	-3.18	-25.60	-8.66
		(6.60)	(3.07)	(20.01)	(5.68)
Middle East	Constant (β_0)	0.80	0.59	0.96	0.70
		(0.63)	(0.21)	(0.72)	(1.06)
Africa	Constant (β_0)	-2.11	-0.59	-3.46	-2.13
		(0.71)	(0.52)	(1.14)	(0.97)

Notes: [1] Standard deviations are in parentheses.
[2] OLS estimation with robust standard errors.
[3] GLS and OLS P-W (Prais-Winsten) estimations with heteroskedastic and serially correlated (panel-specific) errors.
[4] Generalized Estimating Equations (GEE) estimation with AR(1) within-group serial correlation and semi-robust standard errors.

The other regions were between these two polar cases. The forecasts for emerging Asia and transition economies did not have a consistent bias; the forecasts for Latin America were optimistic for growth, but not for inflation; the forecasts for the Middle East were pessimistic for growth, but not for inflation. These results, based on the original data, do not materially change when the bootstrapped data are used (see Appendix II, Table A1). The time series of the forecast errors, as presented in Figures 1 and 2, suggest that the largely unbiased nature of forecasts for emerging Asia may reflect the canceling out of overprediction in some years and underprediction in others for inflation and (as an inspection of the data for individual countries would show) overprediction in some countries and underprediction in others for growth. Likewise, the growth forecasts for transition countries were unbiased, possibly because of the time-series averaging of positive errors in the early 1990s and negative ones in the later years.

Table 2. Testing the Unbiasedness of IMF Year-Ahead Forecasts, 1994–2003[1]

A. Growth

		OLS[2]	GLS[3]	OLS P-W[3]	GEE[4]
Industrial	Constant (β_0)	-0.14	-0.25	-0.17	-0.14
		(0.14)	(0.09)	(0.18)	(0.13)
Emerging Asia	Constant (β_0)	0.25	0.13	0.55	0.21
		(0.33)	(0.26)	(0.42)	(0.34)
Latin America	Constant (β_0)	1.18	1.13	1.38	1.15
		(0.24)	(0.19)	(0.30)	(0.21)
Transition	Constant (β_0)	0.82	0.44	0.85	1.12
		(0.49)	(0.37)	(0.53)	(0.40)
Middle East	Constant (β_0)	-0.43	-0.43	-0.62	-0.43
		(0.34)	(0.25)	(0.43)	(0.35)
Africa	Constant (β_0)	1.14	0.93	1.20	1.12
		(0.24)	(0.15)	(0.26)	(0.35)

B. Inflation

		OLS[2]	GLS[3]	OLS P-W[3]	GEE[4]
Industrial	Constant (β_0)	0.19	0.19	0.21	0.19
		(0.07)	(0.06)	(0.10)	(0.07)
Emerging Asia	Constant (β_0)	-0.93	-0.39	-0.67	-0.88
		(0.98)	(0.43)	(1.44)	(1.54)
Latin America	Constant (β_0)	-0.21	0.10	-0.31	-0.39
		(0.88)	(0.25)	(1.02)	(1.23)
Transition	Constant (β_0)	-21.00	-15.15	-41.98	-21.13
		(11.11)	(5.02)	(19.66)	(10.54)
Middle East	Constant (β_0)	1.73	1.43	1.70	1.67
		(0.74)	(0.27)	(0.72)	(1.37)
Africa	Constant (β_0)	-4.70	-2.99	-7.69	-4.78
		(1.16)	(0.99)	(2.28)	(1.41)

Notes: [1] Standard deviations are in parentheses.
[2] OLS estimation with robust standard errors.
[3] GLS and OLS P-W (Prais-Winsten) estimations with heteroskedastic and serially correlated (panel-specific) errors.
[4] Generalized Estimating Equations (GEE) estimation with AR(1) within-group serial correlation and semi-robust standard errors.

Table 2 replicates the results reported in Table 1 for one year-ahead forecasts (see Appendix Ⅱ, Table A2 for the results based on the bootstrapped data). It turns out that the IMF growth forecasts become more optimistic when the forecast horizon is lengthened. Specifically, the estimated coefficient (β_0) shifts upward for all regions and country groups regardless of the estimation method used, with the result that growth optimism for Latin America and Africa is greater while growth pessimism for industrial countries and the Middle East disappears (the forecasts for emerging Asia and transition economies remain unbiased). For inflation forecasts, however, there was no consistent change in the degree of biasedness across the regions. For industrial countries, emerging Asia, and the Middle East, the IMF forecasts become more pessimistic when the forecast horizon is lengthened, as indicated by the fact that the estimated coefficient shifts upward for all estimation methods. On the other hand, the forecasts become more optimistic for inflation in Africa. For Latin America and transition countries, the direction of bias changes depending on the estimation method used. It is generally the case that the year-ahead inflation forecasts were unbiased for Latin America but biased for transition economies.

The results of testing the efficiency (or the joint hypothesis of unbiasedness and no serial correlation) of IMF forecasts are reported in Table 3 (the results based on the bootstrapped data are reported in Appendix II, Table A3). It is generally the case that the IMF forecasts were efficient for regions where they were found to be unbiased. Both the growth and inflation forecasts were efficient for emerging Asia, while this was also the case for the growth forecasts for transition economies and the inflation forecasts for Africa. The inefficiency of inflation forecasts for transition economies may be mainly caused by serial correlation, rather than bias (see Timmermann, 2006). On the other hand, although these results are generally robust to bootstrapping, the inefficiency of inflation forecasts for Latin America disappears in the bootstrapped data.

The results of Table 3 are replicated in Table 4 for one year-ahead forecasts. When the forecast horizon is lengthened, the forecasts become more inefficient, except for transition countries. The test of unbiasedness indicates that the growth forecast errors for all regions shift up, offsetting the pessimism in industrial countries and the Middle East, and strengthening the optimism in Africa and Latin America. The test of efficiency for the year-ahead forecasts shows that the joint test of unbiasedness and no serial correlation cannot be rejected for industrial countries, the Middle East, and emerging Asia. To the extent that the constant term is positive and for the most part statistically significant, the growth forecasts for these regions can also be said to have had a pessimistic bias. Our results are again robust to bootstrapping (see Appendix II, Table A4).

IV. Sources of Forecast Errors

Some may consider our finding of systematic bias in the IMF's growth and inflation forecasts for certain regions as evidence against the rationality of IMF forecasts. Within the specific context of IMF forecasts, however, the nature of the forecasting exercise (in which key global assumptions are made at the outset of each forecasting round) may also be a source of bias (or errors more generally). For example, forecast errors may be caused by either overpredicting or underpredicting certain key global variables upon which the growth and inflation forecasts for individual countries are based.

Alternatively, one can also consider such bias as reflecting specific incentives or wishful expectations on the part of the IMF (for such views in different contexts, see Ito, 1990; Laster et al., 1999). In the past, for example, such optimistic bias for developing countries was attributed to the nature of the IMF's program engagement with these countries. The typically larger forecast errors for developing countries may reflect the greater forecasting difficulty inherent in their characteristically more volatile economic environments.

In what follows, we attempt to identify the sources of optimistic bias in certain developing regions. Because our finding of optimistic bias in these regions was independent of volatility, we do not consider volatility as a cause of systematic errors. Instead, we focus our attention here on (i) errors in forecasting the real effective exchange rate of the US dollar, the real rate of return on US dollar deposits, oil prices, and commodity prices; and (ii) the presence of an IMF lending program.

Table 3. Testing the Efficiency of IMF Current-Year Forecasts, 1994–2003 [1]

		A. Growth					B. Inflation			
		OLS	GLS	OLS P-W	GEE		OLS	GLS	OLS P-W	GEE
Industrial	Constant (β_0)	0.11	0.38	0.18	0.05	Constant (β_0)	-0.01	0.04	0.05	0.03
	β_1	1.11	0.98	1.09	1.13	β_1	0.94	0.92	0.92	0.92
	Wald test	8.38	23.81	17.38	23.19	Wald test	5.39	13.99	4.41	7.70
Emerging Asia	Constant (β_0)	-0.61	-0.02	-0.70	-0.54	Constant (β_0)	-0.55	-0.01	0.43	0.22
	β_1	1.11	1.01	1.10	1.11	β_1	1.22	1.07	1.10	1.12
	Wald test	0.22	0.03	1.15	5.46	Wald test	2.14	4.16	5.78	19.69
Latin America[2]	Constant (β_0)	0.16	0.28	0.17	0.25	Constant (β_0)	2.54	1.76	3.90	4.22
	β_1	0.82	0.80	0.81	0.80	β_1	0.71	0.87	0.66	0.63
	Wald test	5.36	21.57	10.18	10.71	Wald test	1.02	11.26	9.94	5.17
Transition[3]	Constant (β_0)	0.62	0.91	0.39	0.08	Constant (β_0)	-1.87	-2.44	2.72	-2.92
	β_1	0.96	0.80	0.89	0.91	β_1	1.37	1.31	1.40	1.39
	Wald test	0.10	8.66	1.42	1.78	Wald test	19.74	82.16	26.30	37.59
Middle East	Constant (β_0)	2.37	2.35	2.41	2.44	Constant (β_0)	-0.50	0.35	0.54	2.79
	β_1	0.51	0.52	0.53	0.49	β_1	0.95	0.72	0.71	0.51
	Wald test	20.92	59.65	30.63	38.30	Wald test	1.66	14.24	5.18	3.90
Africa	Constant (β_0)	-0.76	0.41	-0.37	-0.71	Constant (β_0)	2.00	0.50	3.15	2.19
	β_1	1.02	0.77	0.89	1.01	β_1	1.01	1.01	1.02	1.00
	Wald test	5.85	35.05	13.45	11.45	Wald test	5.72	1.44	9.66	4.83

Notes: [1] The joint hypothesis $H_0 : \beta_0 = 0$ and $\beta_1 = 1$ is tested with an F-test for OLS, and a Wald test (which is asymptotically distributed $\chi^2(2)$) for the other methods.
[2] 1995–2003 for inflation in Latin America.
[3] 1996–2003 for inflation in transition countries.

Table 4. Testing the Efficiency of IMF Year-Ahead Forecasts, 1994–2003[1]

		A. Growth					B. Inflation			
		OLS	GLS	OLS P-W	GEE		OLS	GLS	OLS P-W	GEE
Industrial	Constant (β_0)	0.82	1.60	1.76	1.88	Constant (β_0)	0.05	0.30	0.06	0.10
	β_1	0.78	0.55	0.53	0.43	β_1	0.91	0.79	0.91	0.89
	Wald test	2.14	47.13	18.23	8.22	Wald test	3.56	25.64	4.71	7.52
Emerging Asia	Constant (β_0)	2.28	4.47	3.42	4.65	Constant (β_0)	5.74	7.06	7.91	8.26
	β_1	0.54	0.11	0.26	0.13	β_1	0.36	0.05	0.14	0.03
	Wald test	4.49	65.32	13.81	61.37	Wald test	5.49	166.18	68.61	135.29
Latin America[2]	Constant (β_0)	-0.13	0.43	0.30	0.58	Constant (β_0)	4.37	4.94	5.75	8.21
	β_1	0.73	0.60	0.56	0.55	β_1	0.58	0.52	0.41	0.29
	Wald test	17.43	42.78	28.62	25.13	Wald test	3.92	67.12	40.62	20.70
Transition[3]	Constant (β_0)	-0.73	0.97	0.52	0.11	Constant (β_0)	16.17	14.49	42.46	16.53
	β_1	0.98	0.64	0.67	0.64	β_1	1.23	0.89	0.97	1.22
	Wald test	1.53	8.96	5.74	13.40	Wald test	2.22	8.02	5.11	4.78
Middle East	Constant (β_0)	2.73	2.98	2.98	2.91	Constant (β_0)	1.73	2.18	2.89	5.30
	β_1	0.35	0.27	0.34	0.30	β_1	0.38	0.12	0.06	-0.09
	Wald test	33.92	60.89	29.80	107.88	Wald test	11.05	517.16	169.18	129.45
Africa	Constant (β_0)	-1.09	0.92	0.89	-1.05	Constant (β_0)	6.15	4.95	9.42	8.11
	β_1	0.99	0.62	0.57	0.99	β_1	0.86	0.78	0.81	0.75
	Wald test	12.00	69.23	34.10	15.36	Wald test	18.51	31.16	28.61	31061.70

Notes:[1] The joint hypothesis $H_0 : \beta_0 = 0$ and $\beta_1 = 1$ is tested with an F-test for OLS, and a Wald test (which is asymptotically distributed $\chi^2(2)$) for the other methods.
[2] 1995–2003 for inflation in Latin America.
[3] 1996–2003 for inflation in transition countries.

Forecast errors on global variables

Table 5 reports the results of estimating equation (3) for the IMF's current-year forecast errors. The errors in forecasting the key global variables seemed to have greater impact on the IMF's growth forecasts for individual countries when the region concerned is more closely integrated with international capital markets, such as Latin America. The lower than expected interest rates in the United States and, to a much less (albeit statistically significant) extent, the forecast errors on oil prices accounted for a significant portion of the optimism observed in Latin America. This is not the case for the other regions.

Different patterns are observable for different regions or country groups. First, the forecast errors on oil prices had a negative impact on the Middle East and Latin America, where a number of countries are net oil exporters; the forecast errors for oil prices had a positive impact on industrial countries and emerging Asia, where the countries are by and large net oil importers.[14] The positive coefficient for the oil price forecast error means that an underprediction of oil prices (which was almost consistently observed during the sample period) increases (decreases) the extent to which growth is underpredicted (overpredicted) in industrial countries and emerging Asia. On the one hand, this might seem contradictory because higher than expected oil prices could lead to an economic slowdown through their impact on input prices. On the other hand, negative forecast errors on oil prices may be capturing a positive shock to global economic activity that is difficult to identify precisely. The differences in the impact of forecast errors on oil prices could also to some extent be an outcome of spurious correlation.

Whatever the reason may be, the significant correlation between the assumption errors (except for the errors on the real effective exchange rate for large economies) and the macroeconomic forecast errors may mean that more accurate global assumptions could improve the IMF's forecasts, at least for Latin America. On the other hand, such improvement would have the least impact in Africa, where the global factors do not play a significant role in explaining the accuracy of forecasts.

In contrast to these results for the current-year forecasts, the global factors do not seem to have accounted for a significant portion of the one year-ahead forecast errors for Latin America (Table 6). The global factors, however, do seem to have played a more important role in generating forecasts for emerging Asia and transition economies (note that the forecast errors for the US dollar exchange rate were significant only in emerging Asia). In line with the earlier finding that the optimistic tendency is strengthened when the forecast horizon is lengthened, the constant term becomes statistically insignificant for industrial countries, and the Middle East (where pessimistic tendency was observed for current year forecasts). For transition economies, the forecasts are no longer unbiased when the global factors are considered: there was a systematic tendency to overpredict growth.

[14] The results for industrial countries must be treated with care because of a possible endogeneity problem. It is possible that the forecast errors on oil prices reflect the forecast errors on world economic growth, which is largely determined by growth in industrial countries.

Table 5. Testing the Impact of Errors in Forecasting Global Variables on Current-Year Growth Forecasts, 1994–2003[1]

		GLS[2]	OLS P-W[2]	GEE[3]			GLS[2]	OLS P-W[2]	GEE[3]
Industrial	Constant	-0.30	-0.37	-0.33	Transition	Constant	0.12	0.32	0.47
		(0.07)	(0.11)	(0.13)			(0.33)	(0.4)	(0.37)
	USEXR	0.01	0.06	0.05		USEXR	0.09	0.12	0.16
		(0.02)	(0.03)	(0.04)			(0.08)	(0.10)	(0.10)
	USINT	1.02	0.83	0.83		USINT	-1.86	-2.86	-2.92
		(0.11)	(0.18)	(0.20)			(0.49)	(0.61)	(0.85)
	Petroleum	0.02	0.02	0.02		Petroleum	0.02	0.03	0.03
		(0.00)	(0.01)	(0.01)			(0.01)	(0.02)	(0.02)
	Nonfuel	-	-	-		Nonfuel	-0.02	-0.06	-0.06
		-	-	-			(0.02)	(0.03)	(0.03)
	R^2		0.26			R^2		0.12	
Emerging Asia	Constant	0.23	0.52	0.43	Middle East	Constant	-0.99	-1.33	-1.06
		(0.18)	(0.27)	(0.34)			(0.21)	(0.33)	(0.35)
	USEXR	-0.01	0.00	0.00		USEXR	0.04	0.08	0.05
		(0.04)	(0.07)	(0.05)			(0.07)	(0.09)	(0.07)
	USINT	-0.16	-0.1	-0.16		USINT	0.2	-0.03	0.01
		(0.26)	(0.4)	(0.34)			(0.43)	(0.58)	(0.74)
	Petroleum	0.04	0.05	0.06		Petroleum	-0.02	-0.05	-0.04
		(0.01)	(0.01)	(0.02)			(0.01)	(0.02)	(0.02)
	Nonfuel	0.02	0.04	0.02		Nonfuel	0.05	0.06	0.06
		(0.01)	(0.02)	(0.01)			(0.02)	(0.03)	(0.03)
	R^2		0.21			R^2		0.10	
Latin America	Constant	0.14	-0.05	0.01	Africa	Constant	0.70	0.68	0.55
		(0.16)	(0.23)	(0.17)			(0.14)	(0.26)	(0.24)
	USEXR	0.11	0.09	0.07		USEXR	-0.07	-0.02	-0.03
		(0.04)	(0.06)	(0.05)			(0.04)	(0.07)	(0.07)
	USINT	0.43	1.01	1.01		USINT	0.22	0.36	0.41
		(0.26)	(0.38)	(0.49)			(0.21)	(0.40)	(0.51)
	Petroleum	-0.02	-0.03	-0.03		Petroleum	-0.01	-0.01	-0.01
		(0.01)	(0.01)	(0.01)			(0.01)	(0.01)	(0.02)
	Nonfuel	0.00	0.01	0.00		Nonfuel	-0.01	-0.02	-0.02
		(0.01)	(0.02)	(0.02)			(0.01)	(0.02)	(0.02)
	R^2		0.08			R^2		0.03	

Notes: [1] Standard deviations are in parentheses.

[2] GLS and OLS P-W (Prais-Winsten) estimations with heteroskedastic and serially correlated (panel-specific) errors.

[3] Generalized Estimating Equations (GEE) estimation with AR(1) within-group serial correlation and semi-robust standard errors.

Table 6. Testing the Impact of Errors in Forecasting Global Variables on Year-Ahead Growth Forecasts, 1994–2003[1]

		GLS[2]	OLS P-W[2]	GEE[3]			GLS[2]	OLS P-W[2]	GEE[3]
Industrial	Constant	-0.11	-0.03	-0.01	Transition	Constant	1.55	2.04	2.17
		(0.09)	(0.16)	(0.15)			(0.43)	(0.56)	(0.64)
	USEXR	0.04	0.03	0.02		USEXR	0.10	0.07	0.07
		(0.01)	(0.02)	(0.02)			(0.05)	(0.07)	(0.07)
	USINT	0.52	0.62	0.65		USINT	-0.30	-0.43	-0.38
		(0.05)	(0.09)	(0.10)			(0.25)	(0.34)	(0.31)
	Petroleum	0.01	0.02	0.02		Petroleum	0.04	0.06	0.06
		(0.00)	(0.00)	(0.01)			(0.01)	(0.02)	(0.02)
	Nonfuel	-	-	-		Nonfuel	-0.09	-0.11	-0.11
		-	-	-			(0.04)	(0.05)	(0.06)
	R^2		0.27			R^2		0.12	
Emerging Asia	Constant	-0.02	0.34	0.23	Middle East	Constant	-0.20	-0.14	0.13
		(0.27)	(0.36)	(0.35)			(0.32)	(0.51)	(0.34)
	USEXR	-0.12	-0.15	-0.15		USEXR	0.04	0.12	0.12
		(0.04)	(0.05)	(0.06)			(0.04)	(0.06)	(0.06)
	USINT	0.20	0.18	0.16		USINT	-0.14	-0.39	-0.46
		(0.17)	(0.23)	(0.20)			(0.18)	(0.27)	(0.23)
	Petroleum	0.03	0.05	0.05		Petroleum	0.02	0.02	0.03
		(0.01)	(0.01)	(0.02)			(0.01)	(0.01)	(0.02)
	Nonfuel	0.09	0.12	0.11		Nonfuel	0.02	0.02	0.03
		(0.02)	(0.03)	(0.04)			(0.03)	(0.04)	(0.04)
	R^2		0.32			R^2		0.06	
Latin America	Constant	0.92	1.43	1.32	Africa	Constant	1.01	1.36	1.29
		(0.20)	(0.33)	(0.35)			(0.16)	(0.30)	(0.40)
	USEXR	0.03	0.06	0.08		USEXR	0.00	0.05	0.07
		(0.03)	(0.04)	(0.04)			(0.02)	(0.04)	(0.04)
	USINT	0.26	0.35	0.33		USINT	-0.13	-0.32	-0.33
		(0.12)	(0.19)	(0.21)			(0.09)	(0.17)	(0.16)
	Petroleum	0.00	0.00	0.00		Petroleum	0.00	0.00	0.00
		(0.01)	(0.01)	(0.01)			(0.00)	(0.01)	(0.01)
	Nonfuel	0.02	0.01	0.00		Nonfuel	-0.01	-0.01	-0.01
		(0.02)	(0.03)	(0.04)			(0.01)	(0.02)	(0.03)
	R^2		0.08			R^2		0.06	

Notes: [1] Standard deviations are in parentheses.
[2] GLS and OLS P-W (Prais-Winsten) estimations with heteroskedastic and serially correlated (panel-specific) errors.
[3] Generalized Estimating Equations (GEE) estimation with AR(1) within-group serial correlation and semi-robust standard errors.

IMF programs

Table 7 reports the results of estimating equation (4) for African countries, which suggest that the optimistic bias was related to the presence of an IMF lending program. Further breaking down the countries into (i) those with an IMF program under the Poverty Reduction and Growth Facility (PRGF), (ii) those with a non-PRGF program, and (iii) those without any IMF program, we find no evidence of bias in the IMF's current-year forecasts for nonprogram countries, while the growth forecasts were significantly optimistic in program countries, particularly those with PRGF programs. This result is robust to bootstrapping but contrasts with Ghosh et al (2005) and Timmermann (2006), who claimed that optimism in Africa was not limited to program countries. The optimism for program countries remains for inflation, but there is no difference between PRGF and non-PRGF programs.

Finally, Table 8 reports the results of estimating equation (5) for all countries with an IMF program (for which the IMF had forecasts) during the sample period. In this larger sample (of 61 countries), the growth and inflation forecasts were generally optimistic.[15] When we make a distinction between program and nonprogram years, the optimistic bias in the growth forecasts was limited to the program years. These results may suggest that the bias was related to the presence of an IMF program for growth forecasts, or alternatively that IMF programs were generally more contractionary than had been predicted. On the other hand, the bias in the inflation forecasts was hardly significant for either set of years, so that the significant bias for inflation cannot be attributed to an IMF program.

V. Conclusion

The IMF's macroeconomic forecasts for the period 1994-2003 displayed different directions and degrees of bias for different regions or groups of countries. Most of the empirical results reported in this paper, especially those based on the panel-data GLS estimator (which adjusts for variance, hence forecasting difficulty), suggest that the forecasts were pessimistic for industrial countries but were optimistic for Africa and, to a lesser extent, Latin America.

It appears that the optimistic bias in these regions stemed from the presence of an IMF lending program (in the case of Africa) and errors in forecasting the key global variables (in the case of Latin America). In the former case, the optimistic bias was especially strong for PRGF countries; in the latter case, lower than expected US interest rates and higher than expected oil prices seem to have accounted for a significant portion of the optimism. These results are robust to alternative estimation methods, as well as use of bootstrapping to increase the effective size of the sample.

The forecast errors for emerging Asia and transition countries were also affected by the errors in forecasting the global variables, though in different directions. Further research is needed to understand fully the cross-country differences in the transmission channels of global factors, which must be causing these divergent results. Another extension of this research would be to identify the sources of the pessimistic bias for industrial countries and the Middle East.

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[15] Although more than 90 countries were under an IMF program between 1994 and 2003, the sample here is restricted to countries for which forecasts were made.

Table 7. Testing the Unbiasedness of IMF Current-Year Forecasts for Africa, 1994–2003[1]

A. Growth

	OLS[2]	GLS[3]	OLS P-W[3]	GEE[4]
No program	0.17	0.05	0.10	0.18
	(0.26)	(0.13)	(0.22)	(0.34)
PRGF programs	0.83	0.78	1.09	0.83
	(0.28)	(0.18)	(0.41)	(0.31)
Other programs	0.85	0.99	0.99	0.81
	(0.47)	(0.44)	(0.49)	(0.60)

Bootstrapped sample	OLS[2]	GLS[3]	OLS P-W[3]	GEE[4]
No program	0.17	0.05	0.10	0.18
	(0.25)	(0.39)	(0.40)	(0.37)
PRGF programs	0.83	0.78	1.09	0.83
	(0.27)	(0.27)	(0.49)	(0.31)
Others	0.85	0.99	0.99	0.81
	(0.48)	(0.69)	(0.72)	(0.62)

B. Inflation

	OLS[2]	GLS[3]	OLS P-W[3]	GEE[4]
No program	-2.55	-0.51	-11.10	-2.60
	(1.85)	(2.23)	(7.40)	(2.54)
PRGF programs	-2.17	-0.36	-1.99	-2.20
	(0.81)	(0.63)	(0.84)	(1.26)
Other programs	-1.59	-0.70	-3.84	-1.54
	(1.35)	(1.00)	(2.21)	(1.39)

Bootstrapped sample	OLS[2]	GLS[3]	OLS P-W[3]	GEE[4]
No program	-2.55	-0.51	-11.10	-2.60
	(1.77)	(3.63)	(6.01)	(2.61)
PRGF programs	-2.17	-0.36	-1.99	-2.20
	(0.80)	(1.35)	(1.69)	(1.30)
Other programs	-1.59	-0.70	-3.84	-1.54
	(1.38)	(1.73)	(2.84)	(1.48)

Notes:[1] Standard deviations are in parentheses.

[2] OLS estimation with robust standard errors.

[3] GLS and OLS P-W (Prais-Winsten) estimations with heteroskedastic and serially correlated (panel-specific) errors.

[4] Generalized Estimating Equations (GEE) estimation with AR(1) within-group serial correlation and semi-robust standard errors.

Table 8. Testing the Unbiasedness of IMF Current-Year Forecasts in Countries with an IMF Program, 1994–2003[1]

A. Growth

	OLS	GLS	OLS P-W	GEE
Constant	0.27 (0.13)	0.28 (0.09)	0.33 (0.15)	0.26 (0.13)
Program	0.36 (0.17)	0.41 (0.11)	0.37 (0.20)	0.33 (0.16)
No program	0.11 (0.20)	0.13 (0.12)	0.25 (0.22)	0.14 (0.23)

B. Inflation

	OLS	GLS	OLS P-W	GEE
Constant	-10.06 (4.54)	-3.93 (1.86)	-33.51 (16.13)	-10.57 (5.08)
Program	-7.67 (4.75)	-3.56 (1.86)	-25.36 (15.03)	-7.56 (4.98)
No program	-14.33 (9.40)	-4.78 (2.17)	-45.23 (18.01)	-16.00 (10.52)

Note: [1] Standard deviations are in parentheses.

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Appendix I. Sample Countries[1]

Industrial Countries:	**Asia:**	**Latin America:**	**Transition Economies:**	**Middle East:**	**Africa:**
United States	Bangladesh	Argentina	Albania	Bahrain	Algeria
Japan	China	Bahamas	Azerbaijan	Egypt	Botswana
Germany	India	Bolivia	Belarus	Iran	Cameroon
France	Indonesia	Brazil	Bulgaria	Jordan	Cote d'Ivoire
United Kingdom	Malaysia	Chile	Croatia[2]	Kuwait	Ethiopia
Canada	Myanmar	Colombia	Czech Republic[2]	Lebanon	Gabon
Italy	Nepal	Costa Rica	Estonia	Libya	Ghana
	Pakistan	Dominican Republic	Hungary	Oman	Kenya
Australia	Philippines		Kazakhstan	Qatar	Madagascar
Austria	Sri Lanka	Ecuador	Latvia	Saudi Arabia	Mauritius
Belgium	Thailand	El Salvador	Lithuania	Syria	Morocco
Cyprus	Vietnam	Guatemala	Poland	United Arab Emirates	Nigeria
Denmark		Honduras	Romania		Senegal
Finland		Jamaica	Russia	Yemen[2]	South Africa
Greece		Mexico	Turkey		Sudan
Iceland		Panama	Turkmenistan		Tanzania
Ireland		Paraguay	Ukraine		Tunisia
Israel		Peru	Uzbekistan		Uganda
Korea		Trinidad and Tobago			Zimbabwe
Luxembourg					
Netherlands		Uruguay			
New Zealand		Venezuela			
Norway					
Portugal					
Singapore					
Spain					
Sweden					
Switzerland					

Notes: [1] According to the definition used by the IMF's *World Economic Outlook*. Transition countries combine Central and Eastern Europe and the Commonwealth of Independent States.

[2] Croatia, the Czech Republic, and Yemen are excluded from the sample when one year-ahead forecasts are analyzed because of data limitation.

Appendix II. Results Obtained from Bootstrapped Data

Table A1. The Unbiasedness of IMF Current-Year Forecasts, 1994–2003[1]

A. Growth

		OLS[2]	GLS[3]	OLS P-W[3]	GEE[4]
Industrial	Constant (β_0)	-0.41 (0.10)	-0.36 (0.08)	-0.45 (0.11)	-0.41 (0.10)
Emerging Asia	Constant (β_0)	0.02 (0.23)	0.00 (0.27)	0.22 (0.23)	-0.02 (0.27)
Latin America	Constant (β_0)	0.39 (0.19)	0.37 (0.17)	0.33 (0.20)	0.38 (0.15)
Transition	Constant (β_0)	0.05 (0.35)	-0.24 (0.24)	-0.03 (0.28)	0.17 (0.38)
Middle East	Constant (β_0)	-0.67 (0.29)	-0.75 (0.15)	-0.89 (0.18)	-0.67 (0.26)
Africa	Constant (β_0)	0.66 (0.19)	0.65 (0.26)	0.82 (0.33)	0.65 (0.23)

B. Inflation

		OLS[2]	GLS[3]	OLS P-W[3]	GEE[4]
Industrial	Constant (β_0)	0.17 (0.06)	0.13 (0.05)	0.17 (0.08)	0.17 (0.06)
Emerging Asia	Constant (β_0)	-1.07 (0.57)	-0.74 (0.61)	-1.26 (1.25)	-1.08 (0.89)
Latin America	Constant (β_0)	0.54 (0.75)	-0.05 (0.42)	-0.43 (1.13)	-0.06 (1.02)
Transition	Constant (β_0)	-8.91 (6.68)	-3.18 (3.44)	-25.60 (19.79)	-8.66 (5.48)
Middle East	Constant (β_0)	0.80 (0.62)	0.59 (0.56)	0.96 (1.43)	0.70 (1.05)
Africa	Constant (β_0)	-2.12 (0.71)	-0.59 (0.88)	-3.46 (1.83)	-2.13 (0.91)

Notes:[1] Standard deviations are in parentheses.
[2] OLS estimation with robust standard errors.
[3] GLS and GLS P-W (Prais-Winsten) estimations with heteroskedastic and serially correlated (panel-specific) errors.
[4] Generalized Estimating Equations (GEE) estimation with AR(1) within-group serial correlation and semi-robust standard errors.

Table A2. The Unbiasedness of IMF Year-Ahead Forecasts, 1994-2003[1]

A. Growth

		OLS[2]	GLS[3]	OLS P-W[3]	GEE[4]
Industrial	Constant (β_0)	-0.14	-0.25	-0.17	-0.14
		(0.14)	(0.14)	(0.13)	(0.13)
Emerging Asia	Constant (β_0)	0.25	0.13	0.55	0.21
		(0.33)	(0.38)	(0.32)	(0.36)
Latin America	Constant (β_0)	1.18	1.13	1.38	1.15
		(0.24)	(0.17)	(0.21)	(0.21)
Transition	Constant (β_0)	0.82	0.44	0.85	1.12
		(0.52)	(0.27)	(0.26)	(0.44)
Middle East	Constant (β_0)	-0.43	-0.43	-0.62	-0.43
		(0.34)	(0.35)	(0.38)	(0.32)
Africa	Constant (β_0)	1.14	0.93	1.20	1.12
		(0.24)	(0.30)	(0.37)	(0.33)

B. Inflation

		OLS[2]	GLS[3]	OLS P-W[3]	GEE[4]
Industrial	Constant (β_0)	0.19	0.19	0.21	0.19
		(0.07)	(0.07)	(0.07)	(0.07)
Emerging Asia	Constant (β_0)	-0.93	-0.39	-0.67	-0.88
		(0.99)	(1.27)	(2.15)	(1.37)
Latin America	Constant (β_0)	-0.21	0.10	-0.31	-0.39
		(0.87)	(0.88)	(1.46)	(1.21)
Transition	Constant (β_0)	-21.00	-15.15	-41.98	-21.13
		(11.23)	(6.75)	(23.70)	(9.84)
Middle East	Constant (β_0)	1.73	1.43	1.70	1.67
		(0.72)	(0.74)	(1.78)	(1.26)
Africa	Constant (β_0)	-4.70	-2.99	-7.69	-4.78
		(1.13)	(1.57)	(2.95)	(1.34)

Notes: [1] Standard deviations are in parentheses.

[2] OLS estimation with robust standard errors.

[3] GLS and OLS P-W (Prais-Winsten) estimations with heteroskedastic and serially correlated (panel-specific) errors.

[4] Generalized Estimating Equations (GEE) estimation with AR(1) within-group serial correlation and semi-robust standard errors.

Table A3. The Efficiency of IMF Current-Year Forecasts, 1994–2003[1]

		A. Growth					B. Inflation			
		OLS	GLS	OLS P-W	GEE		OLS	GLS	OLS P-W	GEE
Industrial	Constant (β_0)	0.11	0.38	0.18	0.05	Constant (β_0)	-0.01	0.04	0.05	0.03
		(0.26)	(0.36)	(0.37)	(0.29)		(0.16)	(0.11)	(0.17)	(0.15)
	β	1.11	0.98	1.09	1.13	β	0.94	0.92	0.92	0.92
		(0.09)	(0.12)	(0.12)	(0.11)		(0.08)	(0.04)	(0.07)	(0.07)
	Wald test	15.48	14.26	16.86	21.50	Wald test	10.64	7.57	5.28	7.44
Emerging Asia	Constant (β_0)	-0.61	-0.02	-0.70	-0.54	Constant (β_0)	-0.55	-0.01	0.43	0.22
		(1.06)	(0.57)	(0.41)	(0.53)		(0.81)	(0.89)	(1.55)	(2.13)
	β	1.11	1.01	1.10	1.11	β	1.22	1.07	1.10	1.12
		(0.18)	(0.11)	(0.07)	(0.08)		(0.15)	(0.08)	(0.07)	(0.21)
	Wald test	0.45	0.01	2.88	1.97	Wald test	3.46	1.54	3.68	2.69
Latin America[2]	Constant (β_0)	0.16	0.28	0.17	0.25	Constant (β_0)	2.54	1.76	3.90	4.22
		(0.39)	(0.33)	(0.33)	(0.35)		(1.72)	(1.89)	(2.75)	(2.57)
	β	0.82	0.80	0.81	0.80	β	0.71	0.87	0.66	0.63
		(0.10)	(0.10)	(0.09)	(0.09)		(0.21)	(0.21)	(0.34)	(0.30)
	Wald test	10.19	8.45	8.39	10.96	Wald test	2.32	1.77	4.21	4.09
Transition[3]	Constant (β_0)	0.06	0.91	0.39	0.08	Constant (β_0)	-1.87	-2.44	2.72	-2.92
		(0.46)	(0.40)	(0.40)	(0.42)		(4.89)	(1.35)	(11.12)	(4.55)
	β	0.96	0.80	0.89	0.91	β	1.37	1.31	1.40	1.39
		(0.10)	(0.08)	(0.08)	(0.09)		(0.30)	(0.13)	(0.44)	(0.30)
	Wald test	0.18	5.84	2.36	1.17	Wald test	1.72	5.70	1.55	2.19
Middle East	Constant (β_0)	2.37	2.35	2.41	2.44	Constant (β_0)	-0.50	0.35	0.54	2.79
		(0.37)	(0.53)	(0.57)	(0.43)		(0.99)	(1.17)	(1.36)	(2.25)
	β	0.51	0.52	0.53	0.49	β	0.95	0.72	0.71	0.51
		(0.09)	(0.13)	(0.10)	(0.09)		(0.23)	(0.38)	(0.39)	(0.42)
	Wald test	43.23	20.05	23.69	35.72	Wald test	3.48	1.61	0.86	1.60
Africa	Constant (β_0)	-0.76	0.41	-0.37	-0.71	Constant (β_0)	2.00	0.50	3.15	2.19
		(0.45)	(0.75)	(0.88)	(0.69)		(1.64)	(1.24)	(3.08)	(2.16)
	β	1.02	0.77	0.89	1.01	β	1.01	1.01	1.02	1.00
		(0.09)	(0.13)	(0.16)	(0.13)		(0.16)	(0.13)	(0.21)	(0.20)
	Wald test	12.65	36.74	13.35	11.97	Wald test	12.13	0.52	4.53	6.58

Notes: [1]Standard deviations are in parentheses. The joint hypothesis $H_0: \beta_0 = 0$ and $\beta_1 = 1$ is tested with an F-test for OLS, and a Wald test (which is asymptotically distributed $\chi^2(2)$) for the other methods.

[2]1995–2003 for inflation in Latin America.

[3]1996–2003 for inflation in transition countries.

Table A4. The Efficiency of IMF Year-Ahead Forecasts, 1994–2003[1]

		A. Growth					B. Inflation			
		OLS	GLS	OLS P-W	GEE		OLS	GLS	OLS P-W	GEE
Industrial	Constant (β_0)	0.82	1.60	1.76	1.88	Constant (β_0)	0.05	0.30	0.06	0.10
	β_1	0.78	0.55	0.53	0.43	β_1	0.91	0.79	0.91	0.89
	Wald test	4.48	16.51	16.55	9.14	Wald test	7.98	9.37	5.41	5.05
Emerging Asia	Constant (β_0)	2.28	4.47	3.42	4.65	Constant (β_0)	5.74	7.06	7.91	8.26
	β_1	0.54	0.11	0.26	0.13	β_1	0.36	0.05	0.14	0.03
	Wald test	8.36	35.70	55.74	40.50	Wald test	6.06	11.23	7.86	9.97
Latin America[2]	Constant (β_0)	-0.13	0.43	0.30	0.58	Constant (β_0)	4.37	4.94	5.75	8.21
	β_1	0.73	0.60	0.56	0.55	β_1	0.58	0.52	0.41	0.29
	Wald test	33.71	26.22	34.94	26.77	Wald test	8.14	3.95	6.40	9.69
Transition[3]	Constant (β_0)	-0.73	0.97	0.52	0.11	Constant (β_0)	16.17	14.49	42.46	16.53
	β_1	0.98	0.64	0.67	0.64	β_1	1.23	0.89	0.97	1.22
	Wald test	2.83	10.84	11.84	7.67	Wald test	4.49	2.56	4.79	5.52
Middle East	Constant (β_0)	2.73	2.98	2.98	2.91	Constant (β_0)	1.73	2.18	2.89	5.30
	β_1	0.35	0.27	0.34	0.30	β_1	0.38	0.12	0.06	-0.09
	Wald test	56.39	41.92	43.88	62.64	Wald test	10.35	27.12	14.46	56.45
Africa	Constant (β_0)	-1.09	0.92	0.89	-1.05	Constant (β_0)	6.15	4.95	9.42	8.11
	β_1	0.99	0.62	0.57	0.99	β_1	0.86	0.78	0.81	0.75
	Wald test	24.01	23.17	23.93	16.51	Wald test	24.42	2.67	4.14	10.04

Notes: [1] The joint hypothesis $H_0 : \beta_0 = 0$ and $\beta_1 = 1$ is tested with an F-test for OLS, and a Wald test (which is asymptotically distributed $\chi^2(2)$) for the other methods.
[2] 1995–2003 for inflation in Latin America.
[3] 1996–2003 for inflation in transition countries.