Projecting Macroeconomic Outcomes: How Well has the IMF Done?

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Abstract
In the process of designing of IMF-supported programs, IMF staff members prepare projections of the evolution of key macroeconomic variables for the participating country. These projections are based on countries' initial situations, and are conditioned on the implementation of reforms and policy measures agreed in the context of programs. In this paper, we examine the accuracy of projections in 291 programs approved in the period 1993-2009. We focus on the projections of two macroeconomic aggregates (the ratios of the fiscal surplus to GDP and of external current account surplus to GDP) during the years immediately following the initiation of an IMF-supported program.

We identify five potential reasons for divergence of projected from actual values: (i) mismeasured data on initial conditions; (ii) country-specific differences in forming projections, (iii) projections that do not reflect the dynamic time-series process of the actual data; (iv) policy forecast error; and (v) random errors in the actual data. Our data analysis suggests that the incomplete information on initial conditions and the country-specific differences in projection error are the largest contributors to discrepancies between projection and actual. We also consider whether the IMF's forecasts have gotten more accurate in recent years; there is evidence that they have for the shortest horizons, but the quantitative impact on forecast error is small.

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The Articles of Agreement of the International Monetary Fund define two responsibilities for that organization. First, the IMF extends short-term credit to countries with balance-of-payments deficits, "conditional on the country's commitment to implement economic policies that will restore equilibrium."[1] Second, the IMF conducts periodic consultations with member governments about their exchange-rate arrangement and external balance, and provides advice as appropriate on macroeconomic and exchange-rate policy reforms. It has as goal "to shorten the duration and lessen the degree of disequilibrium in the international balances of payments of members" (International Monetary Fund, 2009, Article I (vi)).

Based on these two responsibilities, the IMF must be in the forecasting business. Any commitment to "implement economic policies that will restore equilibrium" must be evaluated for its ability to do just that in the future. Any commitment to "shorten the duration and lessen the degree of disequilibrium" in a member country will require a reliable forecast of future events in that member country. The properties of IMF forecasts have been studied in the past.[2] Musso and Phillips (2002) discovered a small bias towards optimism in forecasting economic growth and inflation (higher growth and lower inflation forecast than observed). Baqir, Ramchandran and Sahay (2005) extended this analysis through consideration of the IMF's simultaneous forecasts of intermediate policy targets: the optimism of Musso and Phillips, for example, was connected to the country's ability to implement ambitious policy targets. Atoian et al. (2006) considered the IMF's forecast of current account and fiscal balance ratios to GDP, and discovered an optimistic bias in the fiscal balance ratio.

With the financial crisis beginning in 2007, the IMF's ability to predict downturns and to devise macroeconomic policy responses to international shocks has come back into the spotlight. Dreher et al. (2008) presented evidence of political determinants of IMF forecasts; Vaubel (2009) noted the IMF's poor forecasting performance relative to other groups in the forecast business, such as the Economists' Consensus, the OECD and the German Economic Expert Council. It is appropriate at this time to ask once again the question: "How well does the IMF do in forecasting macroeconomic outcomes for countries participating in programs?"[3]

We make a number of contributions to the current literature on IMF forecasting. Most obvious is the expanded time dimension: we are able to include countries that began participation in IMF programs during the financial crisis beginning in 2007. Second, we consider the implicit dynamic macro time-series processes that have been used to generate the macroeconomic forecast and (separately) the observed macroeconomic outcomes for the participant countries. The previous cited research (with the exception of Atoian et al. (2006)) has treated macroeconomic projection values as independent random variables. We go beyond that to model in a non-restrictive form the auto-regressive time-series processes underlying both the projections and the observed variables. While there is no single "IMF model", Baqir, Ramcharan and Sahay (2005) and Easterly (2006) both describe financial-programming

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[1] See Boughton (2006, p. 19).

[2] See Musso and Phillips (2002), Atoian et al. (2003), and Baqir, Ramcharan and Sahay (2005) for earlier studies of the unbiasedness and precision of IMF forecasts.

[3] We do not ask the related question: "Was the IMF able to predict the onset and spread of the current financial crisis?" in this paper. Conway (2010) provides a survey on what the IMF knew, and when it knew it, in comparison to governmental actors and ratings agencies.

identities from the fiscal and balance-of-payments accounts that are used to give consistency and structure to IMF forecasts.[4] We provide a general estimating structure that nests those constraints in a dynamic auto-regressive model with potential reversion to a long-run value. We do not in this paper address the importance of policy adjustment to the precision of projections, but in future work we will follow Baqir et al. (2005) in specifying explicitly the link between intermediate policy targets and the endogenous variables of interest.

We examine two endogenous variables in both forecast and observed outcomes. The first is the ratio of fiscal balance to GDP. Given the IMF commitment to fiscal sustainability in its member countries (as evidenced in writings from Chalk and Hemming (2000) to Escolano (2010)), its ability to forecast this ratio will be a critical sign of forecasting success. The second is the ratio of the current account balance to GDP as an indicator of the potential external disequilibria addressed in the Articles of Agreement.[5]

We identify four potential reasons for divergence of projected from actual values: (i) mismeasured data on initial conditions; (ii) inability of IMF staff to incorporate realistic time-series properties of the actual data into projections; (iii) country-specific differences in projection errors; and (iv) random errors in the actual data. Our data analysis suggests that the incomplete information on initial conditions and the country-specific differences in projection errors are the largest contributors to discrepancies between projection and actual. We find evidence that the IMF's forecasts have gotten more accurate in recent years, but the quantitative impact on forecast error is small.

I. Data.

The IMF records projected macroeconomic outcomes in its Monitoring of Arrangements (MONA) database. For each program, the IMF staff prepares a projection of the participating country's future performance. This projection is based upon the country's initial situation and upon the predicted impact of reforms agreed upon in the context of the IMF program.[6] IMF staff record a new set of forecasts at each review of the program (in general, every three or six months). We will compare these projections to actual data for the same years. These actual data are drawn from the IMF's World Economic Outlook (WEO) database in June 2010. We create this comparison for the 291 programs approved in the period 1993-2009.

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[4] Easterly (2006), in fact, demonstrates that a naïve application of financial programming is not justified in these data. Our dynamic application will provide a structure within which Easterly's concerns about exogeneity of regressors can be addressed.

[5] We will return in subsequent work to apply this methodology to the study of economic growth. This will allow a direct comparison of the value of our approach to those of Musso and Phillips (2002) and Baqir, Ramcharan and Sahay (2005).

[6] We will hold to a specific definition of "projections" in this paper. We do not consider projections to be identical to "forecasts". We define a forecast to be the best prediction possible of what is to occur at a given time in the future. A projection in this context is a prediction based upon the participating country undertaking and completing all structural and policy reforms agreed to in the Letter of Intent approved between the participating government and the IMF. The two could diverge if the best prediction includes only partial implementation of policy and structural reform.

Given the difference in sources, some data manipulation is necessary to ensure comparability.[7] The data are redefined in each case to be relative to the initial program year: it is denoted the "year T" of the program.[8] In this study, we will examine four projection "horizons", which are all made at the time of program approval. For each projection horizon, we will compare the IMF staff projection with the historical outcome. The year prior to "year T" is denoted T-1. The horizon-T data will be projections of macroeconomic outcomes in period T based upon information available in T-1: in other words, a one-year ahead projection. The horizon-T+1 data are projections of macroeconomic outcomes in period T+1 based upon information available in T-1, and are as such two-year-ahead projections. The horizon-T+2 and horizon T+3 projections are defined analogously. The number of observations available differs for each projection horizon due to (a) missing projection data or (b) projection horizons that extend beyond the end of the available historical data. The number of program-inception observations available for comparisons is as follows for the four horizons: 291, 275, 259 and 235 for horizons T through T+3.[9] Figure 1 illustrates the number of independent IMF-supported programs beginning in each of the years. Of the total, 194 programs were begun in the period 1993-2001.

We will focus upon two macroeconomic aggregates. The historical fiscal surplus as a share of GDP for country j in year t will be denoted g_{jt}. The historical current-account surplus as a share of GDP will be denoted c_{jt}. The projections of these two variables will be denoted $\hat{g}_{jt}$ and $\hat{c}_{jt}$, respectively. Other variables will be introduced as necessary and defined at that time. It will be useful for exposition to describe projections of these ratios as the change observed in the ratio between period T-1 (just before the program began) and the end of the time horizon. We use the notation $\Delta\hat{g}_{jk}$ and $\Delta\hat{c}_{jk}$ to represent the change in the projection ratio between period T-1 and the end of horizon k: for example, $\Delta\hat{c}_{jT+1} = \hat{c}_{jT+1} - \hat{c}_{jT-1}$. Historical data from WEO are differenced analogously.

We will use observations in the years 1993-2001 to derive a benchmark for assessment of IMF forecasting ability over time. In the aftermath of the Asian Crisis of 1997 and the Russian Crisis of 1998 there was a loud and concerted objection to the IMF's implementation of its crisis lending program. Many informed observers (e.g., Sachs (1997), Feldstein (1998), IFIAC (2000), Stiglitz (2002)) attributed the slow recovery from the crisis to the IMF's behavior. Many of the criticisms were targeted at the IMF's lending role, particularly with regard to its insistence on conditionality. In response to concerns that the IMF did not anticipate the Asian and Russian financial crises, the IMF established an internal Vulnerability Exercise for Emerging Market Economies (VEE) in 2001 to focus the surveillance efforts of Fund staff on weaknesses in

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[7] For example, the projections are reported on an annual basis but the year for a given country is not invariably a calendar year. The fiscal year was used as the basis for MONA data collection and forecasting, while the calendar year was used in the actual WEO data. When the two did not coincide, the historical data were converted into fiscal-year equivalents through weighted-average conversion of the calendar-year data.

[8] The "year T" of each program is defined by IMF staff to be that fiscal year (as defined by the country) in which the program is approved. Programs are typically not approved at the beginning of year T, but rather at some point within the year. .

[9] When a single country participates in two IMF programs that begin in the same year, we exclude one of the two; our reasoning is that the projections for that country should coincide for the two programs. When the two are consecutive programs, we exclude the earlier; when the two are simultaneous programs (for example, a stand-by and EFF agreed upon simultaneously but reported separately) we exclude the non-stand-by program.

sectoral fundamentals. It also encouraged staff research into "early warning systems" to identify macroeconomic indicators of impending crisis.[10] We investigate whether this concerted effort to enhance Fund surveillance produced any tangible results in terms of better projection capacity in post-2001 period.

Each program is treated as an independent observation in what follows. However, it is important to note that the database includes numerous programs for many participating countries. These programs may overlap for a given country, in the sense that the initial year (year T) for one program may coincide with a projection year (e.g., year T+2) for a second program in that country. Our auto-regressive modeling process provides a structure for those many-program countries, and thus is an improvement over earlier static treatments. We also control for constant country- (and time-) specific differences in our regression analysis.[11]

II. What Does The Record Show?

For an initial pass, we compare the unconditional historical outcomes for the countries participating in IMF-supported programs with the outcomes projected by IMF staff when the programs were originally approved. When we compare the median of $\Delta\hat{g}_{jk}$ and $\Delta\hat{c}_{jk}$ for various projection horizons k with the median of the actual Δg_{jk} and Δc_{jk}, we find that projections differ substantially from those actually observed.

Figure 2 illustrates the median improvements in IMF-program countries for the full sample and for the sample split into pre-2002 and post-2001 subsamples. Each row of graphs illustrates one variable – fiscal balance across the top, and current-account balance across the bottom. The dotted line indicates the median projected outcome, while the solid line indicates the median actual outcome. In the full sample (the left-hand column) median changes in projected and historical *fiscal balance* ratios are nearly coincident for horizon T, while for longer horizons the historical and projected changes diverge sharply. The projected improvement in the fiscal ratio rises with the length of the horizon; at horizon T+3, the projected increase in the fiscal ratio is nearly 1.5 percentage points. The median change actually observed over those time horizons for the same countries was quite different; just over 0.5 percentage points for horizon T, but rising very little in horizons T+2 and T+3. In the pre-2002 sample the discrepancy is even more pronounced: the MONA projection was of over 2.5 percentage-point improvement in the fiscal balance, while the WEO actual record was of a 0.5 percentage point gain in horizon T maintained through subsequent horizons. In the post-2001 sample, the median improvement in fiscal balance in IMF forecast undershot the actual improvement in these years. The median horizon-T forecast was zero in this period, although it increased to nearly a one percentage-point improvement by horizon T+3. at about the same rate through longer horizons, than in the full-sample. By horizon T+3, the actual and forecast improvements were almost identical in the post-2001 period – while in the early sample they differed by over 2 percentage points.

[10] Berg and Patillo (1999), Kumar, Moorthy and Perraudin (2003) and Caramazza, Ricci and Salgado (2004) are reports on these efforts to devise "early warning systems". They were less than perfectly successful; in fact, Berg and Patillo (1999, p. 127) report that two regression-based models they considered were "no better than guesswork" while a third "model explains only 28 percent of the variation in actual crisis rankings".

[11] In future work we will consider clustering errors by country to incorporate alternative country-specific effects.

The projected and actual improvements in the current account are illustrated in the lower row of graphs in Figure 2. In the full sample, the median change in the *current account balance* ratio begins at a positive 0.2 percentage points in horizon T for both projected and actual. For horizons T+1 and later, the projected current-account ratio continues to improve: by horizon T+3 the cumulative improvement is about 1.5 percentage points. The actual ratio, by contrast, gives back its horizon-T gains in T+1. By horizon T+3, the current-account ratio exhibits a 0.1 percentage-point improvement over period T-1 – smaller by 1.5 percentage points than that projected. This divergence of projection and actual stem from the pre-2001 experience. The median improvement in horizon T was about 0.25 percent for both projected and actual. However, by horizon T+3 the median current account ratio was projected to improve by nearly 3 percentage points, while the actual ratio showed almost no improvement. In the post-2001 sample, IMF median forecast of current-account ratio improvement was less optimistic in each horizon, with horizon-T forecast improvement of zero rising to a cumulative improvement of 0.5 percent projected by horizon T+3. The actual median improvement was negative until horizon T+3, when the cumulative improvement was only 0.1 percentage points.

In Figure 3, we report the median improvement in fiscal and current accounts by type of program. The first column of graphs describes the first sample, and is identical to the first column in Figure 2. The middle column describes the projections and actual outcomes for stand-by arrangements. Stand-by arrangements (or SBAs) are the traditional financial agreement of the IMF, and relative to other agreements have more demanding conditionality. The right-hand column presents median outcomes for all other agreements, including Extended Fund Facility (EFF), Structural Adjustment Facility (SAF), Extended Structural Adjustment Facility (ESAF), Poverty Reduction and Growth Facility (PRGF), and others. All graphs in Figure 3 are for the complete sample. In examining the fiscal balance, we see that forecasts were closer to actual for the subset of countries with SBAs. The horizon-T forecast was identical to actual; while forecast improvement exceeded actual improvement, the difference was rather small through horizon T+2. By contrast, the difference between forecast and actual in median non-SBA programs is striking from the beginning. The projected outcome is of an initial 0.5 percentage-point improvement followed by steady further improvement until a cumulative effect in horizon T+3 of over 1.5 percentage points. The actual outcome follows a quite different path: larger initial median improvement in horizon T, but followed by a regression in subsequent years leading to a cumulative improvement of 0.6 percentage points by horizon T+3. The differences between SBA and non-SBA programs are not as pronounced for the current-account ratio in the bottom row of graphs. SBA programs are projected to begin with a 0.5 percentage point increase in horizon T, while non-SBA programs begin with zero increase at that horizon. Both projections then rise monotonically through horizon T+3. The actual median outcomes also began with a 0.5 percentage-point difference in horizon T, but both then trended downward in subsequent years. Only in horizon T+3 do the non-SBA countries experience an improvement that brings the cumulative effect into the positive range.

It is not surprising the projections are inexact at any projection horizon. Nor is it surprising that the shortest horizon exhibits the closest fit to the actual, since longer-horizon projections required predictions on intermediate-year outcomes that almost surely will be inexact. The projections record as illustrated in Figures 2 and 3 raises two important research questions. First, what are the causes of projection error at any horizon? Second, can we identify causes for systematic bias in projections over longer horizons? We will pursue the second question in future work. In this paper, we will decompose the projection error for horizon T into potential sources of imprecision to determine the relative contribution of each. .

III. Four Sources of Projection Error.

We begin with g_T, a macroeconomic variable observed at time T.[12] Define s_T as the vector of policy forcing variables observed at time T. Denote the projection of Δg_T to be

$$\Delta\hat{g}_T = f(X_{T-1,}\ \Delta\hat{s}_T) \tag{1}$$

with X_{T-1} a matrix representing that information available to the forecaster at time T-1 and $\hat{s}_T$ the matrix of projected policy outcomes consistent with the government's Letter of Intent.[13] The actual evolution of the variable g_T can be represented by the expression

$$\Delta g_T = \phi(\zeta_{T-1},\ \Delta s_T) \tag{2}$$

with ζ_{T-1} the matrix of forcing variables at time T-1 (including a random error in time T), s_T the matrix of observed policy outcomes and ϕ the true reduced-form model. Projection error can then be represented by the difference $(\Delta\hat{g}_T - \Delta g_T)$.[14]

$$(\Delta\hat{g}_T - \Delta g_T) = \phi(\zeta_{T-1},\ \Delta s_T) - f(X_{T-1},\ \Delta\hat{s}_T) \tag{3}$$

There are four potential sources for this projection error. First, the projection model f(.) may not be identical with the true model ϕ(.). Second, the historical policy adjustment (Δs_T) may differ from the projected policy adjustment ($\Delta\hat{s}_T$). Third, the information set X_{T-1} available for the projections may not include the same information as the forcing vector ζ_{T-1} for the true process. Finally, there is random error in realizations of the macroeconomic variable.

Consider a simple example: there is a single projection of change in a variable g_T. The forcing matrix is simply the lagged variables g_{T-1} and g_{T-2}.[15] The policy matrix is represented by the single instrument s_T. Equations (1) and (2) can then be rewritten in the following form:

$$\Delta\hat{g}_T = a_1\ \Delta\hat{g}_{T-1} + a_2\ (g_{T-1} + \eta_{T-1}) + b_1\ \Delta\hat{s}_{T-1} \tag{1e}$$

$$\Delta g_T = \alpha_1\ \Delta g_{T-1} + \alpha_2\ g_{T-1} + \beta_1\ \Delta s_{T-1} + \varepsilon_T \tag{2e}$$

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[12] We first used this decomposition in Atoian, Conway, Selowsky and Tsikata (2003). That remains a good introduction to the technique.

[13] By contrast, we consider the prediction of Δg_T to be defined $\Delta g^e_T = f(X_{T-1};s^e_T)$, with s^e_T representing the forecaster's best prediction as of period T-1 of the policy vector to be observed in period T.

[14] Hendry (1997) provides an excellent summary of the possible sources of projection (in his case forecasting) error when the projection model is potentially different from the actual model. This example can be thought of as a special case of his formulation.

[15] g_{T-2} enters the expression through the term Δg_{T-1}.

The coefficients (α_1, α_2, β_1) represent the true model while (a_1, a_2, b_1) are coefficients from the model used for projections. In the projection rule, the forecaster perceives $\hat{g}_{T-1} = (g_{T-1} + \eta_{T-1})$ with η_{T-1} a random error. This imprecision may occur because the information set available to the forecaster is less precise than the information set available after later revisions. The variable ε_T represents the stochastic nature of realizations of the actual variable.

$$(\Delta g_T - \Delta\hat{g}_T) = [(\alpha_1 - a_1)\,\Delta\hat{g}_{T-1} + (\beta_1 - b_1)\Delta\hat{s}_{T-1} + (\alpha_2 - a_2)\,\hat{g}_{T-1}] + \beta_1(\Delta s_{T-1} - \Delta\hat{s}_{T-1})$$

$$+ [\alpha_1(\Delta g_{T-1} - \Delta\hat{g}_{T-1}) + \alpha_2\,(g_{T-1} - \hat{g}_{T-1})] + [\varepsilon_T - a_2\,\eta_{T-1}] \tag{3e}$$

The projection error (3e) thus illustrates the four components mentioned above. First, there is the possibility that the projection differs in time series properties from that evident in the historical data; this will lead to the errors summarized in the first square bracket. Second, there could be a divergence between the projected policy adjustment and the actual policy adjustment. Third, there is the potential that projection error is due to mismeasurement of initial conditions or in past forecasts. Fourth, the error may simply be due to the stochastic nature of the variable being projected.

In the sections that follow we decompose the projection error into these four parts for the fiscal balance-to-GDP ratio and the current account balance-to-GDP ratio in countries with IMF-supported programs. First, we create a reduced-form model that represents well the evolution of the actual data. We estimate the model implicit in the projected data, and compare the coefficients from this projection model to those from the actual data. Second, we examine the envisaged and historical data for evidence that revisions in the data led to the discrepancies. Third, we perform a decomposition exercise to determine the percentages of deviations of projection from historical that can be attributed to country-specific differences, differences in time-series properties, differences in initial conditions, differences in policy response, or simply random variation in the historical data.

IV. Conditional Means of Fiscal and Current Account Balances.

We begin with general vector autoregression processes in the two ratios. To illustrate for AR(2) processes:[16]

[16] We will refer to the "error-correction form" as one that includes both lagged differences and lagged levels of the two variables as explanatory variables for the current differenced variables. This can be derived from a general AR specification of the two variables; the AR(2) specification is used here for ease of illustration. The form presented in the text can be derived from the following AR(2) set of equations.

$$g_{jt} = a_o + a_{11}g_{jt-1} + a_{12}g_{jt-2} + b_{11}c_{jt-1} + b_{12}\,c_{jt-2} + \varepsilon_{yjt}$$

$$c_{jt} = b_o + a_{21}g_{jt-1} + a_{22}g_{jt-2} + b_{21}c_{jt-1} + b_{22}\,c_{jt-2} + \varepsilon_{cjt}$$

Specification tests are used to choose the lag length appropriate to the empirical work. In a world in which g_{jt} and c_{jt} are non-stationary but are cointegrated on a country-by-country basis, further simplification is possible. If g_{jt} and c_{jt} are non-stationary in the current dataset, then equation (7) represents a cointegrating relationship. The "error

$$\Delta g_{jt} = a_o - a_{12}\,\Delta g_{jt-1} - b_{12}\,\Delta c_{jt-1} + (a_{11}+a_{12}-1)\,g_{jt-1} + (b_{11} + b_{12})c_{jt-1} + \varepsilon_{yjt} \qquad (4a)$$

$$\Delta c_{jt} = b_o - a_{22}\,\Delta g_{jt-1} - b_{22}\,\Delta c_{jt-1} + (a_{21}+a_{22})\,g_{jt-1} + (b_{12}+b_{22}-1)c_{jt-1} + \varepsilon_{zjt} \qquad (4b)$$

The system of equations (4) will hold for all t, and thus should be in evidence at time T when the IMF-supported program is introduced. The system has excluded policy interventions from the derivation for simplicity, but it is straightforward, though arithmetically messy, to introduce them. One way to do so will be through definition of a policy response function, by which Δs_{jT} is itself a function of c_{jT-1} and $g_{jT-1.}$ The second will be to incorporate the policy variables as exogenous forcing variables. The approach we use will incorporate parts of each.

The VAR structure proposed here can be thought of as a reduced-form approximation to any unspecified structural model (Holden (1995)). The specification in first-differenced terms alone will be sufficient if the two variables are not cointegrated. However, it is incomplete if there is potential cointegration of g_{jt} and c_{jt}. This is a plausible feature of the relation between these two ratios, as we demonstrate. We begin with the macro identity:

$$g_{jt} \equiv c_{jt} - p_{jt} \qquad (5)$$

holding for all countries j and time periods t. g_{jt} is the fiscal surplus as a share of GDP, c_{jt} is the current-account surplus as a share of GDP, and p_{jt} is private net saving (i.e., private saving minus private investment) as a share of GDP.

We posit as well that there is a "normal" level of private saving specific to each country and to each time period. This normal level $p^{n}{}_{jt}$ can be represented by a country-specific component, a component that is common to all countries for a given time period, and a positive relationship between foreign net saving opportunities and private net saving.

$$p^{n}{}_{jt} = \alpha_j + \beta_t + \delta\, c_{jt} \qquad (6)$$

Combining (5) and (6), and defining $e_{jt} = (p_{jt} - p^{n}{}_{jt})$ as the randomly distributed excess private net saving in any period, yields

$$g_{jt} = -\,\alpha_j - \beta_t + (1-\delta)\,c_{jt} - e_{jt} \qquad (7)$$

thus providing a static link (and cointegrating relationship) between g_{jt} and c_{jt} based upon the financial-programming identity (4) as in Easterly (2006). With the Granger Representation Theorem, we can present this vector autoregression with cointegrated variables in the error-

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correction" variable ec_{jt} can then be inserted in the equations (7) in place of the terms in g_{jt-1} and c_{jt-1} and will have the coefficient associated with g_{jt-1} in (7). It is impossible to verify a non-stationary relationship in this dataset, given that we have only scattered observations from each country's time series. We do investigate that possibility in the second and fourth columns of Tables 2 and 3, with support for that interpretation of the error-correction term in the Δg_{jt} equation. Hamilton (1994, chapter 19) provides a clear derivation of this error-correction form from the underlying autoregression.

correction form. There is in general no way to assign contemporaneous causality in (4a) and (4b) – or in (7). If it were possible to assert that the current-account ratio is exogenously determined, for example, then the contemporaneous change Δc_{jt} could be a separate regressor in the Δg_{jt} equation to account for that contemporaneous correlation. In the estimation that follows, we will report Granger causality tests to investigate this.

The econometric effects modeled in equations (4) can be divided into three groups. The first group, represented by the terms in Δc_{jt-1} and Δg_{jt-1}, capture the autoregressive structure of the system. The second group, represented by the terms in g_{jt-1} and c_{jt-1}, capture the adjustment of these variables in response to deviations from the "normal" relationship described in (7). Although the direction of contemporaneous causality cannot be verified, there is a version of dynamic causality that can be checked. The third group represents random errors.

Estimation using historical data.

The results of Table 1 summarize the coefficient estimates from equations (4) for all programs in the sample at horizon T using historical data.[17] Limitations of the MONA data preclude use of lags greater than two, but in the fully specified model, as will be evident, the second lag rarely has significant coefficient. The contemporaneous causality imposed upon the model is that changes in the fiscal account are caused by changes in the current account, and not vice versa.[18] The first set of columns includes the basic error-correction specification. The second set of columns adds country-specific and time-specific effects (not reported). The third column is the most complete specification with error-correction model, year- and country-specific effects, and lagged exchange rate (e_{t-1}) and government consumption (u_{t-1}) ratios as explanatory variables. The number of observations (N), R^2 statistic and F statistic of the hypothesis that the right-hand side regressors are jointly insignificant are reported at the bottom of the page. Standard errors are reported in parentheses below each regression coefficient, and coefficients significantly different from zero at the 95 percent confidence level are printed in bold. We will focus upon the results in the last pair of columns.

For the fiscal balance-to-GDP ratio (g_{iT}), the estimation results suggest the following insights:

- There is significant positive contemporaneous correlation between the two variables, and the normalization chosen here assigns causation to Δc_{jT}. For a one percent increase in the current-account ratio, there is a 0.23 percent increase in the fiscal ratio.

- The current first-difference responds negatively (but not significantly) to shocks in the own ratio in previous periods. Past positive current-account shocks have small and offsetting effects on Δg_{jT}.

[17] Statistical confidence in this paper will be measured at the 90 percent, 95 percent and 99 percent levels. In the text, statistical significance will indicate a degree of confidence greater than 95 percent unless otherwise indicated.

[18] This assumption will be justified, for example, if the participating country is constrained in its international borrowing, so that the ratio of current-account surplus to GDP is set by foreign lenders. The converse is also possible: if the government is the primary importer, then an exogenous improvement in the fiscal balance (through less consumption) will improve the current-account balance. The direction of causality is not critical to this analysis.

- The coefficient on g_{jt-1} is significantly different both from zero and from negative one. It implies that for an average country, a deviation from its "normal" fiscal account ratio will lead to an adjustment in the next period that erases 31 percent of that deviation.

- The "policy" variables contribute insignificantly to this specification.

For the ratio of current account to GDP:

- There is a strong lagged effect of the own first-difference with coefficient -0.25. This is a dramatic indicator of the "sudden stop" nature of the change in current-account balance associated with participation in an IMF-supported program. First-differenced effects of g_t have insignificant spillover to the current account.

- The coefficient on c_{jT-1} of -0.48 is significantly different from both zero and negative one. It indicates that almost one-half of any deviations of the current account ratio from its normal value are made up in the following period.

- The lagged projected policy variables have no significant impact on the current account ratios.

Estimation using the projected data.

If we interpret the estimated model of the preceding section to be the "true" model (2), we posit that IMF projections should have similar time-series properties. We use similar econometric techniques to those of the previous section to derive the relation implied by the projections. We report the results of this estimation exercise in Table 2 for projection horizon T.

Table 2 includes three sets of regressions – as in the previous section, we focus upon the most complete specification in the third set of columns. Looking first at the fiscal account:

- There is an insignificant contemporaneous correlation between the projected fiscal and current-account ratios.

- A one percentage-point increase in last period's fiscal ratio will trigger a 0.56 percentage-point decrease in this period's ratio. This response is significant, and is more than was observed in the historical data. The two-period lagged effect is insignificant here as in the actual data.

- Lagged effects of the current-account ratio make insignificant contributions, just as in the actual data.

There is evidence of an error-correction effect as in the actual data. The coefficient on the lagged fiscal ratio is -0.50, indicating a 50-percent adjustment during the period to previous-period imbalance; this is a more rapid adjustment than observed in the actual data.
For the current account ratio:

- The current account forecast equation has a larger "sudden stop" lagged effect than in the actual data (-0.43). This is partially counteracted by the significant positive coefficient on the own value lagged two periods.

- There is a significant error correction effect in the current account ratio, although the coefficient value (-0.29) is significantly less than observed in the actual data.

There is an important loss in observations from inclusion of both policy variables in the MONA regressions. Given that these proved to make insignificant contributions in these regressions, we have chosen to include only the government consumption variable in the remainder of the analysis.[19]

Decomposing the Difference between Actual and Forecast.

The derivation of equation (3e) provides us with a means to decompose the observed difference between actual and forecast current-account and fiscal-balance ratios.

Table 3 reports the results of a regression on projection error: the actual ratio minus the projected ratio. The sample for estimation purposes includes 183 observations; the data lost represent the intersection of missing data from the two databases. The first set of columns (with no time- and country-level effects) divides the forecast error into two parts: variation due to differing initial conditions and random variation.[20] The R^2 statistics indicate the importance of differing initial conditions in this specification, with 30 and 25 percent of total variation attributable to these differences. The second set of columns includes year-specific effects: this will pick up any error in forecasting aggregate trends across years in current account and fiscal balance. There is little change in the coefficients of the "initial conditions" regressors. The third set of columns reports the results for structural coefficients when time- and country-specific effects are included. The country-specific effect will be non-zero if the IMF forecast for the average ratio for a specific country differs from the observed average ratio. As is evident, there is a strong effect of these country-specific forecast errors. They are in themselves jointly significant (test statistic not reported) in both equations, and they lead to a sharpening of the "sudden stop" and "error correction" effects observed in the preceding columns. Policy projection error is added in the final set of columns of Table 3; these errors contribute little to the explanation of projection error.[21]

Table 3 provides a good first pass at the projection error decomposition, but it omits two potentially important sources of error: differing "models", and a structural change in 2001. Table 4 reports the expanded test of the decomposition described in equation (3e). In addition to the "actual minus projected" variables, the projected variable alone is introduced to pick up the

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[19] Our research agenda for the future will include an exploration of other indicators of policy stance (e.g., the monetary policy) that are more readily available in the MONA database.

[20] Type is also included as a regressor; this takes a value of one if the IMF program is SBA, and zero otherwise. It is not significant in any of the regressions, here or to follow. In future research we will examine whether Type becomes significant when interacted with slope coefficients.

[21] This is due in part to the construction of our policy variable. Since it enters only in lagged terms, we are not capturing the projection error associated with incomplete policy implementation. We will add this to the analysis in future research.

effects of differences in autoregressive parameters in the forecast – i.e., the model used. The first set of columns reports the same results as the last set of columns in Table 3 for purposes of comparison. The second set of columns adds the projection regressors to that specification to identify the importance of the IMF's projection embodying a different time-series process from that of the actual data. The difference in residual variation between the two indicates the contribution of a difference in "model" to forecast error. Addition of these regressors is jointly significant in both equations.[22]

Table 5 answers the question raised in the introduction: do we observe any difference in forecast or actual outcomes after 2001? The post-2001 effects are identified through interaction of a post-2001 dummy variable with the explanatory variables. As is evident in the results, there has been only an insignificant change in the actual current-account equation, but a significant adjustment in the forecast equation – in particular, the error-correction effect has become more negative for the fiscal ratio and less negative for the current-account ratio. In the post-2001 period, the adjusted error-correction terms tell us that the current account ratio has exhibited less rapid adjustment to a "sudden stop" when programs begin than the IMF has projected, while the reversal in fiscal imbalance in the actual data is more rapid than the IMF has projected.[23]

Table 6 provides a formal and complete decomposition of the projection error using the error variation reported in the earlier tables.[24] The difference in initial conditions (i.e., the fact that the IMF is projecting based upon data that differ from those finally reported in the WEO) is an important cause of projection error in the fiscal balance (25 percent) and the current-account ratio (30 percent). The effects of projection "models" that differ from actual models can be broken into three parts. The "slope coefficient" deviation, corresponding to the $(\alpha_1 - a_1)$, $(\beta_1 - b_1)$ and $(\alpha_2 - a_2)$ terms in equation (3e), explain 7 and 6 percent, respectively, of the two projection errors. The "country-specific" deviation, representing the difference in "intercept coefficient" effects in the two equations, explain 35 and 37 percent of total variation respectively. Time-specific projection error contributes a small share of forecast error: 8 percent for the current account and 4 percent for the fiscal balance. The changes in IMF projections posited to occur post-2001 made a small contribution: only 5 and 3 percent of total variation in the two equations could be attributed to changes in forecasting post-2001. The random variation remaining in this decomposition represents 22 and 15 percent of total variation in current-account and fiscal-balance equations, respectively.[25]

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[22] The F(8,97) and F(9,96) statistics for the current-account and fiscal-balance variables are 4.10 and 3.62, respectively, both exceeding the critical value of 2.03 (for current-account balance) or 1.98 (for fiscal balance) at the 95 percent level of confidence.

[23] There is a danger of overfitting when so many regressors are used, and the pattern of significant coefficients on fiscal ratio and government consumptions suggests that this is occurring in the fiscal-ratio regression. This doesn't invalidate the decomposition, but it does suggest that a more parsimonious specification will be preferred.

[24] If there is correlation among the right-hand-side regressors, this decomposition will not be unique: the proportion associated with mismeasured initial conditions, for example, could be overstated due to correlation with the regressors used to measure differences in structural models. We will investigate this possibility in future work.

[25] The order of introduction into regression will change the percentage decomposition. We investigate the importance of this by reversing the regressions of policy variables and country-specific effects. For the current account ratio, this raises the policy projection error contribution to .017, or 3 percent, rather than the 1 percent listed. (The country-specific effect is reduced by 2 percentage points.) For the fiscal ratio, it leaves the policy projection error unchanged.

V. Conclusions and extensions.

Projected and historical observations on the fiscal and current-account ratios in countries participating in 291 IMF programs between 1993 and 2009 deviated strongly from one another. In section II we illustrated this deviation over a three-year projection horizon. We demonstrated using unconditional medians that the deviations in projection error were small in the initial year (horizon T), but grew in longer horizons. We then used an analysis conditional on deterministic factors to decompose the projection error into four components.

First, the IMF staff was apparently working with quite different information about the initial conditions of the program countries than is currently accepted as historical. This difference would lead to substantial forecast error even if the IMF staff had used the same "model" revealed by the historical data. This result is consistent with the conclusions of Orphanides (2001) and Callan, Ghysels and Swanson (2002) on the making of US monetary policy.

Second, there are substantial country-specific differences in projection error. Our results do not allow us to differentiate between country-specific deviations from the actual error-correction model and country-specific systematic projection differences by IMF staff. Table 1 and Table 2 both attest to the importance of country-specific effects in describing deviations from the common "model" represented by the autoregressive process. The large contribution of "country-specific" effects of Table 6 indicates that the country-specific effects in Tables 1 and 2 did not coincide – the country-specific shifts in the actual data were not offset by country-specific adjustments in the IMF projection. One interpretation is simply that the IMF incorporates these effects imperfectly in its projections. A second interpretation is that the country-specific effects in IMF projections are driven by factors other than those embodied in the actual data. This latter interpretation is consistent with the conclusions of Dreher et al. (2008), as cited earlier. Our future research will investigate the appropriate attribution of these projection errors.

Third, evidence indicated only a minor deviation between the time-series process implicit in the IMF forecasts and the time-series process evident in the actual data. These differences contributed only a small percent of the total forecast error.

Fourth, policy projection error played only a small role in forecasting error. This may have been implicit in the research design: we considered only one policy tool, and we considered its effect only with a lag. Given the country-specific nature of policy, it is likely that the large share of projection error currently attributed to country-specific effects will be reallocated to policy projection error once we introduce more policy tools and a contemporaneous impact of policy on our macroeconomic outcomes.

Fifth, there is evidence of only small improvements in forecast error after 2001. Programs were implemented subsequent to the Asian Crisis to improve the IMF ability to forecast and respond to crisis, but in these data the evident benefits of that are small.[26]

While these are important findings, we see three major areas for extension of these results. First, our illustration of median improvements in the two ratios over the varying time horizons made it clear that there was relatively little projection error in horizon T. The longer horizons are more interesting in this regard, and our future research will investigate these. Second, for data-availability reasons we did not include measures of projected and historical implementation of policy adjustment. As Musso and Phillips (2002) noted, this is an important potential source of projection error. In future research we will look carefully at this channel within the framework of the analysis presented here. Third, we would like to use the information on periodic revisions to projections provided in MONA to create a dynamic portrait of the convergence of IMF-staff projections to actual over time. In a related paper (Atoian, Conway, Selowsky and Tsikata (2003)) we have reported our analyses of IMF staff revisions to its projections, using the methodology of Musso and Phillips (2002). These results indicate that the IMF staff learns from past projection errors and from new information. However, even that learning leaves large gaps to fill. The largest margin for improvement may well be in "just-in-time" data collection, so that the errors due to incomplete information, especially from initial conditions, can be eliminated.

[26] This conclusion appears to be in conflict with the graphical evidence of Figure 2. There is in actuality no conflict, because the data analyzed in this paper only consider horizon T. The improvement evident in the post-2001 period in Figure 2 is found in the longer horizons.

Bibliography

Atoian, R., P. Conway, M. Selowsky and T. Tsikata: "Macroeconomic Adjustment in IMF-Supported Programs: Projections and Reality", chapter 4 in G. Ranis, J. Vreeland and S. Kosack: Globalization and the Nation State. New York, NY: Routledge, 2006.

Baqir, R., R. Ramcharan and R. Sahay: "IMF Programs and Growth: Is Optimism Defensible?", IMF Staff Papers 52/2, 2005, pp. 260-286.

Barkley, T.: "IMF Urges US to Consider Higher Taxes, Social Security Cuts", Wall Street Journal Digital Network, Economy, 8 July 2010.

Barro, R. and J. Lee: "IMF Programs: Who is Chosen and What are the Effects?", Journal of Monetary Economics 52/7, 2005, pp. 1245-1269.

Berg, A. and C. Patillo: "Are Currency Crises Predictable? A Test", IMF Staff Papers 46/2, 1999, pp. 107-138.

Boughton, J.: "Who's in Charge? Ownership and Conditionality in IMF-supported programs", chapter 1 in G. Ranis, J. Vreeland and S. Kosack: Globalization and the Nation State. New York, NY: Routledge, 2006.

Callan, M., E. Ghysels and N. Swanson: "Monetary Policy Rules with Model and Data Uncertainty", Southern Economic Journal 69, 2002, pp. 239-265.

Caramazza, F., L. Ricci and R. Salgado: "International Financial Contagion in Currency Crises", Journal of International Money and Finance 23, 2004, pp. 51-70.

Chalk, N. and R. Hemming: "Assessing Fiscal Sustainability in Theory and Practice", IMF Working Paper 00/81, 2000.

Clements, M., and D. Hendry: "Forecasting in Cointegrated Systems", Journal of Applied Econometrics 10, 1995, pp. 127-146.

Conway, P.: "IMF Lending Programs: Participation and Impact", Journal of Development Economics 45, 1994, pp. 365-391.

Conway, P.: "The IMF and the International Financial Crisis", processed, 2010.

Dreher, A., S. Marchesi and J. Vreeland: "The Political Economy of IMF Forecasts", Public Choice 137, 2008, pp. 145-171.

Easterly, W.: "An Identity Crisis? Examining IMF Financial Programming", World Development 34/6, 2006, pp. 964-980.

Escolano, J.: "A Practical Guide to Public Debt Dynamics, Fiscal Sustainability and Cyclical Adjustment of Budgetary Aggregates", Fiscal Affairs TNM 10/02, International Monetary Fund, 2010.

Feldstein, M.: "Refocusing the IMF", Foreign Affairs, March/April 1998.

Hendry, D.: "The Econometrics of Macroeconomic Forecasting", The Economic Journal 107, 1997, pp. 1330-1357.

Holden, K.: "Vector Autoregression Modeling and Forecasting", Journal of Forecasting 14, 1995, pp. 159-166

Howrey, E. P.: "Data Revision, Reconstruction and Prediction: An Application to Inventory Investment", Review of Economics and Statistics 66/3, 1984, pp. 386-393.

International Financial Institution Advisory Commission (IFIAC): Report. Washington, DC: Government Printing Office, 2000.

International Monetary Fund: Articles of Agreement (10 August 2009). Accessed at http://www.imf.org/external/pubs/ft/aa.

Knowledge@Wharton: "Why Economists Failed to Predict the Financial Crisis", 13 May 2009.

Kumar, M., U. Moorthy and W. Perraudin: "Predicting Emerging Market Currency Crashes", Journal of Empirical Finance 10, 2003, pp. 427-454.

Meese, R. and K. Rogoff: "Empirical Exchange Rate Models of the Seventies: Do They Fit Out of Sample?", Journal of International Economics 14, 1983, pp. 3 – 24.

Musso, A. and S. Phillips: "Comparing Projections and Outcomes of IMF-supported Programs", IMF Staff Papers 49/1, 2002, pp. 22-48.

Orphanides, A.: "Monetary Policy Rules, Macroeconomic Stability and Inflation: A View from the Trenches", Working Paper, Federal Reserve Board of Governors, 2001.

Sachs, J.: "The Wrong Medicine for Asia", op-ed piece, New York Times, 3 November 1997.

Stiglitz, J.: Globalization and its Discontents. New York, NY: W.W. Norton, 2002.

Vaubel, R.: "Lessons from the Financial Crisis: the International Dimension", Economic Affairs 29/3, 2009.

Table 1: **Actual Outcomes (WEO) for IMF-Supported Program Countries**

	Δc_t	**Δg_t**	**Δc_t**	**Δg_t**	**Δc_t**	**Δg_t**
Constant	-0.008	0.004				
	(0.005)	(0.004)				
Δc_t		**0.12**		**0.22**		**0.23**
		(0.05)		(0.08)		(0.08)
Δc_{t-1}	**-0.07**	-0.01	**-0.26**	0.05	**-0.25**	0.05
	(0.09)	(0.07)	(0.09)	(0.10)	(0.09)	(0.10)
Δg_{t-1}	0.09	-0.11	**0.22**	**-0.20**	0.31	-0.22
	(0.10)	(0.08)	(0.09)	(0.09)	(0.11)	(0.12)
Δc_{t-2}	**-0.18**	-0.02	-0.06	-0.00	-0.05	-0.02
	(0.09)	(0.07)	(0.09)	(0.09)	(0.09)	(0.09)
Δg_{t-2}	-0.22	-0.13	**-0.26**	-0.03	**-0.23**	0.02
	(0.11)	(0.09)	(0.10)	(0.10)	(0.10)	(0.11)
Δe_{t-1}					0.00	0.00
					(0.00)	(0.00)
Δu_{t-1}					0.08	-0.08
					(0.11)	(0.12)
Δe_{t-2}					0.00	0.00
					(0.00)	(0.00)
Δu_{t-2}					0.05	0.01
					(0.10)	(0.11)
c_{t-1}	**-0.14**	0.00	**-0.47**	0.09	**-0.48**	0.09
	(0.04)	(0.04)	(0.06)	(0.07)	(0.06)	(0.07)
g_{t-1}	0.06	**-0.15**	0.13	**-0.33**	0.18	**-0.31**
	(0.05)	(0.04)	(0.07)	(0.07)	(0.05)	(0.08)
Type	0.01	-0.007	-0.002	0.003	0.001	0.001
	(0.006)	(0.004)	(0.007)	(0.007)	(0.007)	(0.008)
Time and country effects	N	N	Y	Y	Y	Y
N	259	259	259	259	252	252
R^2	0.10	0.11	0.67	0.50	0.67	0.46
F	**4.25**	**3.87**	**3.74**	**1.81**	**3.66**	**1.44**

Table 2: **Forecast Outcomes (MONA) for IMF-Supported Program Countries**

	$\Delta\hat{c}_t$	$\Delta\hat{g}_t$	$\Delta\hat{c}_t$	$\Delta\hat{g}_t$	$\Delta\hat{c}_t$	$\Delta\hat{g}_t$
Constant	**-0.01**	0.004				
	(0.005)	(0.005)				
$\Delta\hat{c}$		**0.15**		**0.16**		0.02
		(0.06)		(0.08)		(0.11)
$\Delta\hat{c}_{t-1}$	**-0.36**	-0.09	**-0.42**	0.05	**-0.43**	-0.03
	(0.05)	(0.05)	(0.06)	(0.07)	(0.08)	(0.09)
$\Delta\hat{g}_{t-1}$	**0.11**	**-0.01**	-0.03	**-0.55**	-0.03	**-0.56**
	(0.05)	(0.05	(0.13)	(0.12)	(0.18)	(0.18)
$\Delta\hat{c}_{t-2}$	-0.02	-0.07	0.05	-0.03	**0.22**	0.10
	(0.05)	(0.05)	(0.07)	(0.06)	(0.10)	(0.10)
$\Delta\hat{g}_{t-2}$	-0.10	0.10	-0.09	-0.12	-0.07	-0.01
	(0.09)	(0.08)	(0.12)	(0.12)	(0.17)	(0.17)
$\Delta\hat{e}_{t-1}$					0.003	-0.002
					(0.006)	(0.005)
$\Delta\hat{u}_{t-1}$					0.25	-0.31
					(0.17)	(0.17)
$\Delta\hat{e}_{t-2}$					-0.006	0.004
					(0.008)	(0.008)
$\Delta\hat{u}_{t-2}$					0.18	0.23
					(0.18)	(0.18)
$\hat{c}_{t-1}$	**-0.12**	-0.02	**-0.19**	0.03	**-0.29**	-0.08
	(0.03)	(0.03	(0.06)	(0.06)	(0.08)	(0.09)
$\hat{g}_{t-1}$	**0.00**	0.11	-0.09	**-0.27**	-0.26	**-0.50**
	(0.07)	(0.06)	(0.10)	(0.10)	(0.14)	(0.15)
	-0.002	0.003	-0.015	0.000	-0.019	
	(0.006)	(0.006)	(0.008)	(0.008)	(0.013)	
Time and country effects	N	N	Y	Y	Y	Y
N	235	235	235	235	195	195
R^2	0.28	0.08	0.58	0.47	0.69	0.60
F	**12.84**	**2.55**	**2.11**	1.30	**1.64**	1.10

Table 3: **Forecast Error for IMF-Supported Program Countries**								
	$\Delta c_t - \Delta\hat{c}_t$	$\Delta g_t - \Delta\hat{g}_t$	$\Delta c_t - \Delta\hat{c}_t$	$\Delta g_t - \Delta\hat{g}_t$	$\Delta c_t - \Delta\hat{c}_t$	$\Delta g_t - \Delta\hat{g}_t$	$\Delta c_t - \Delta\hat{c}_t$	$\Delta g_t - \Delta\hat{g}_t$
Constant	**0.02**	0.004						
	(0.006)	(0.003)						
$\Delta c_t - \Delta\hat{c}_t$		0.04		0.04		0.05		0.06
		(0.04)		(0.04)		(0.06)		(0.06)
$\Delta c_{t-1} - \Delta\hat{c}_{t-1}$	**-0.46**	0.06	**-0.44**	0.07	**-0.51**	**0.13**	**-0.49**	**0.13**
	(0.07)	(0.04)	(0.07)	(0.04)	(0.08)	(0.06)	(0.08)	(0.06)
$\Delta g_{t-1} - \Delta\hat{g}_{t-1}$	0.12	**-0.51**	0.17	**-0.50**	-0.07	**-0.77**	0.14	**-0.76**
	(0.15)	(0.08)	(0.13)	(0.08)	(0.21)	(0.13)	(0.22)	(0.13)
$\Delta c_{t-2} - \Delta\hat{c}_{t-2}$	**0.16**	-0.02	**0.18**	-0.03	**0.32**	-0.02	**0.33**	-0.02
	(0.07)	(0.04)	(0.07)	(0.04)	(0.08)	(0.05)	(0.08)	(0.05)
$\Delta g_{t-2} - \Delta\hat{g}_{t-2}$	0.18	0.10	0.09	0.12	0.04	0.10	-0.01	0.14
	(0.12)	(0.06)	(0.12)	(0.06)	(0.13)	(0.08)	(0.14)	(0.08)
$\Delta u_{t-1} - \Delta\hat{u}_{t-1}$							-0.16	0.05
							(0.12)	(0.07)
$\Delta u_{t-2} - \Delta\hat{u}_{t-2}$							-0.14	0.13
							(0.12)	(0.07)
$c_{t-1} - \hat{c}_{t-1}$	**-0.26**	0.006	**-0.27**	0.02	**-0.44**	0.09	**-0.42**	0.08
	(0.06)	(0.03)	(0.06)	(0.03)	(0.07)	(0.05)	(0.07)	(0.05)
$g_{t-1} - \hat{g}_{t-1}$	0.12	**-0.27**	0.20	**-0.25**	-0.28	**-0.35**	-0.30	**-0.33**
	(0.15)	(0.08)	(0.16)	(0.08)	(0.22)	(0.14)	(0.22)	(0.14)
Type	0.003	-0.002	0.003	-0.000	0.020	0.006	0.018	0.007
	(0.008)	(0.004)	(0.008)	(0.004)	(0.011)	(0.007)	(0.012)	(0.007)
Time Effect	N	N	Y	Y	Y	Y	Y	Y
Country Effect	N	N	N	N	Y	Y	Y	Y
N	183	183	183	183	183	183	183	183
R^2	0.30	0.25	0.38	0.29	0.75	0.64	0.75	0.65
F	**10.63**	**5.76**	**4.25**	**2.68**	**2.65**	**1.57**	**2.62**	**1.59**
Total error	0.6319	0.1566	0.6319	0.1566	0.6319	0.1566	.6319	0.1566
Residual error	0.4434	0.1173	0.3915	0.1112	0.1595	0.0560	.1558	0.0541

Table 4: **Forecast Error including Differences in "Model"**

	$\Delta c_t - \Delta\hat{c}_t$	$\Delta g_t - \Delta\hat{g}_t$	$\Delta c_t - \Delta\hat{c}_t$	$\Delta g_t - \Delta\hat{g}_t$
$\Delta c_t - \Delta\hat{c}_t$		0.06		0.08
		(0.06)		(0.09)
$\Delta c_{t-1} - \Delta\hat{c}_{t-1}$	**-0.49**	**0.13**	**-0.60**	0.04
	(0.08)	(0.06)	(0.16)	(0.11)
$\Delta g_{t-1} - \Delta\hat{g}_{t-1}$	0.14	**-0.76**	0.15	**-0.90**
	(0.22)	(0.13)	(0.28)	(0.17)
$\Delta c_{t-2} - \Delta\hat{c}_{t-2}$	**0.33**	-0.02	0.14	-0.16
	(0.08)	(0.05)	(0.19)	(0.12)
$\Delta g_{t-2} - \Delta\hat{g}_{t-2}$	-0.01	0.14	**-0.74**	-0.08
	(0.14)	(0.08)	(0.25)	(0.17)
$\Delta u_{t-1} - \Delta\hat{u}_{t-1}$	-0.16	0.05	-0.14	-0.08
	(0.12)	(0.07)	(0.18)	(0.11)
$\Delta u_{t-2} - \Delta\hat{u}_{t-2}$	-0.14	0.13	**-0.32**	0.03
	(0.12)	(0.07)	(0.15)	(0.09)
$c_{t-1} - \hat{c}_{t-1}$	**-0.42**	0.08	**-0.58**	**0.16**
	(0.07)	(0.05)	(0.09)	(0.07)
$g_{t-1} - \hat{g}_{t-1}$	-0.30	**-0.33**	-0.11	-0.23
	(0.22)	(0.14)	(0.24)	(0.12)
Type	0.018	0.007	0.007	-0.003
	(0.012)	(0.007)	(0.012)	(0.007)
$\Delta\hat{c}_t$				0.04
				(0.10)
$\Delta\hat{c}_{t-1}$			-0.07	0.003
			(0.18)	(0.12)
$\Delta\hat{g}_{t-1}$			0.18	-0.09
			(0.22)	0.14
$\Delta\hat{c}_{t-2}$			-0.09	**-0.25**
			(0.19)	(0.12)
$\Delta\hat{g}_{t-2}$			**-0.73**	-0.13
			(0.25)	(0.17)
$\Delta\hat{u}_{t-1}$			-0.02	-0.11
			(0.23)	(0.14)
$\Delta\hat{u}_{t-2}$			**-0.47**	-0.05
			(0.21)	(0.14)
$\hat{c}_{t-1}$	**-0.42**	0.08	**-0.26**	**0.23**
	(0.07)	(0.05)	(0.12)	(0.09)
$\hat{g}_{t-1}$	-0.30	**-0.33**	0.08	-0.23
	(0.22)	(0.14)	(0.20)	(0.12)
Time & country effects	Y	Y	Y	Y
N	183	183	183	183
R^2	0.75	0.65	0.78	0.72
F	**2.62**	**1.59**	**3.22**	**1.80**
Residual component	.1558	0.0541	0.1152	0.0431
Total variation	.6319	0.1566	0.6319	0.1566

Table 5: **Forecast Error Decomposition Accounting for Post-2001 Effects**

	$\Delta c_t - \Delta\hat{c}_t$	$\Delta g_t - \Delta\hat{g}_t$	$\Delta c_t - \Delta\hat{c}_t$	$\Delta g_t - \Delta\hat{g}_t$
$\Delta c_t - \Delta\hat{c}_t$		0.08		0.05
		(0.09)		(0.10)
$\Delta c_{t-1} - \Delta\hat{c}_{t-1}$	**-0.60**	0.04	**-0.41**	0.03
	(0.16)	(0.11)	(0.20)	(0.13)
$\Delta g_{t-1} - \Delta\hat{g}_{t-1}$	0.15	**-0.90**	0.10	**-0.74**
	(0.28)	(0.17)	(0.33)	(0.20)
$\Delta c_{t-2} - \Delta\hat{c}_{t-2}$	0.14	-0.16	0.13	-0.03
	(0.19)	(0.12)	(0.20)	(0.12)
$\Delta g_{t-2} - \Delta\hat{g}_{t-2}$	**-0.74**	-0.08	**-0.63**	-0.22
	(0.25)	(0.17)	(0.27)	(0.19)
$\Delta u_{t-1} - \Delta\hat{u}_{t-1}$	-0.14	-0.08	-0.11	-0.19
	(0.18)	(0.11)	(0.18)	(0.11)
$\Delta u_{t-2} - \Delta\hat{u}_{t-2}$	**-0.32**	0.03	-0.27	-0.01
	(0.15)	(0.09)	(0.15)	(0.09)
$c_{t-1} - \hat{c}_{t-1}$	**-0.58**	**0.16**	**-0.66**	0.12
	(0.09)	(0.07)	(0.10)	(0.09)
$g_{t-1} - \hat{g}_{t-1}$	-0.11	-0.23	-0.03	-0.27
	(0.24)	(0.12)	(0.31)	(0.19)
$\Delta\hat{c}_t$		0.04		0.03
		(0.10)		(0.14)
$\Delta\hat{c}_{t-1}$	-0.07	0.003	0.07	0.01
	(0.18)	(0.12)	(0.21)	(0.11)
$\Delta\hat{g}_{t-1}$	0.18	-0.09	0.20	-0.14
	(0.22)	0.14	(0.24)	(0.15)
$\Delta\hat{c}_{t-2}$	-0.09	**-0.25**	0.10	-0.19
	(0.19)	(0.12)	(0.20)	(0.12)
$\Delta\hat{g}_{t-2}$	**-0.73**	-0.13	**-0.81**	-0.16
	(0.25)	(0.17)	(0.28)	(0.19)
$\Delta\hat{u}_{t-1}$	-0.02	-0.11	0.06	-0.16
	(0.23)	(0.14)	(0.23)	(0.14)
$\Delta\hat{u}_{t-2}$	**-0.47**	-0.05	-0.38	-0.04
	(0.21)	(0.14)	(0.25)	(0.14)
$\hat{c}_{t-1}$	**-0.26**	**0.23**	-0.21	**0.25**
	(0.12)	(0.09)	(0.13)	(0.10)
$\hat{g}_{t-1}$	0.08	-0.23	0.08	**-0.33**
	(0.20)	(0.12)	(0.20)	(0.13)
Type	0.007	-0.003	0.008	-0.001
	(0.012)	(0.007)	(0.012)	(0.007)

Post-2001						
$\Delta c_{t-1} - \Delta \hat{c}_{t-1}$					0.27	-0.05
					(0.36)	(0.23)
$\Delta g_{t-1} - \Delta \hat{g}_{t-1}$					-0.11	**-0.62**
					(0.47)	(0.28)
$\Delta c_{t-2} - \Delta \hat{c}_{t-2}$					0.14	-0.21
					(0.31)	(0.19)
$\Delta g_{t-2} - \Delta \hat{g}_{t-2}$					**-0.81**	0.03
					(0.28)	(0.19)
$\Delta u_{t-1} - \Delta \hat{u}_{t-1}$					0.32	**0.71**
					(0.44)	(0.27)
$\Delta u_{t-2} - \Delta \hat{u}_{t-2}$					0.09	0.41
					(0.38)	(0.24)
$c_{t-1} - \hat{c}_{t-1}$					**0.66**	0.09
					(0.30)	(0.20)
$g_{t-1} - \hat{g}_{t-1}$					-0.41	**-0.73**
					(0.48)	(0.30)
Time and country effects		Y	Y		Y	Y
N		183	183		183	183
R^2		0.78	0.72		0.85	0.78
F		**3.22**	**1.80**		**3.28**	**1.99**
Error component		0.1152	0.0431		0.0972	0.0348
F(8,68) joint test of Post-2001 significance: 95% critical value is 1.951					1.58	**2.05**

Table 6: **MONA Forecast Error Decomposition**				
	Δc_t - $\Delta \hat{c}_t$		Δg_t - $\Delta \hat{g}_t$	
	Sum of squares	Percent of total	Sum of squares	Percent of total
Total Error	0.632	100	0.1566	100
Initial conditions	0.188	30	0.039	25
Structural differences				
-time	0.052	8	0.006	4
-slope	0.041	6	0.014	7
-country-specific	0.232	37	0.055	35
Policy projection error	.004	1	0.002	1
Post-2001 changes	0.018	3	0.008	5
Random error	0.097	15	0.035	22

Figure 1: Number of IMF-Supported Programs Approved

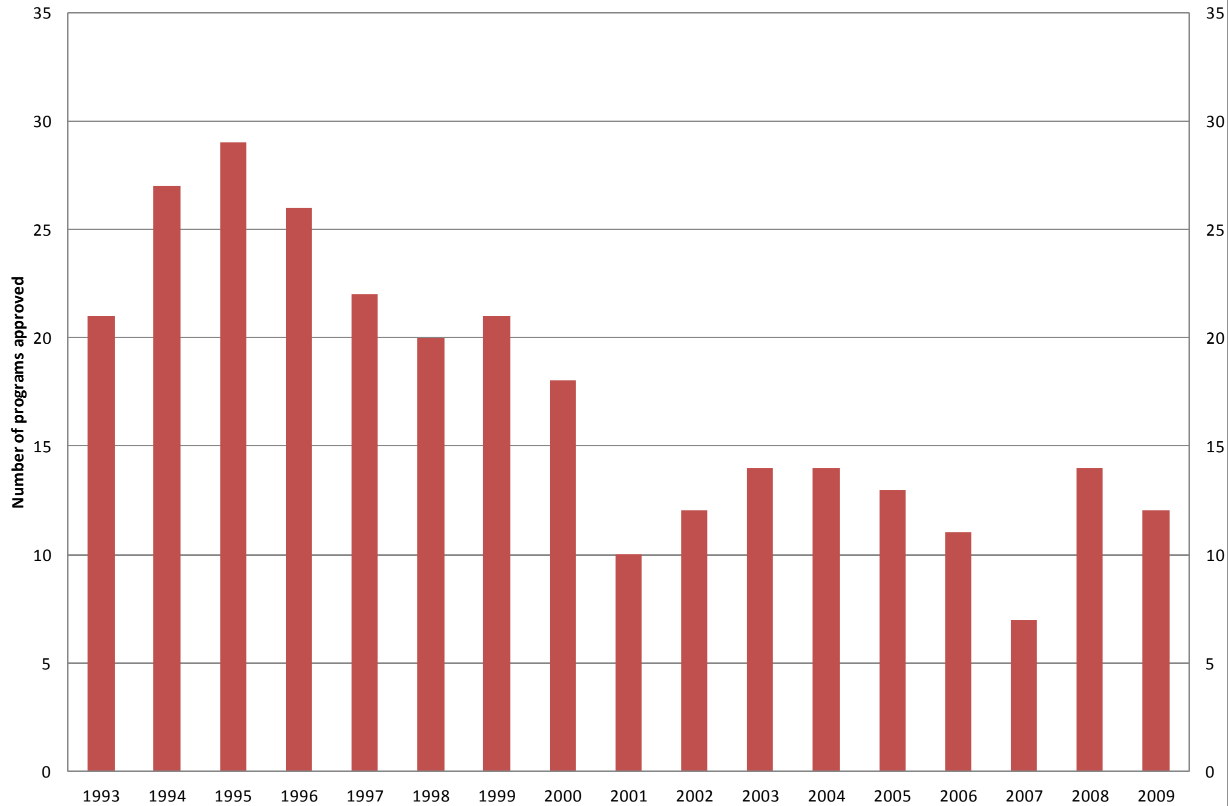
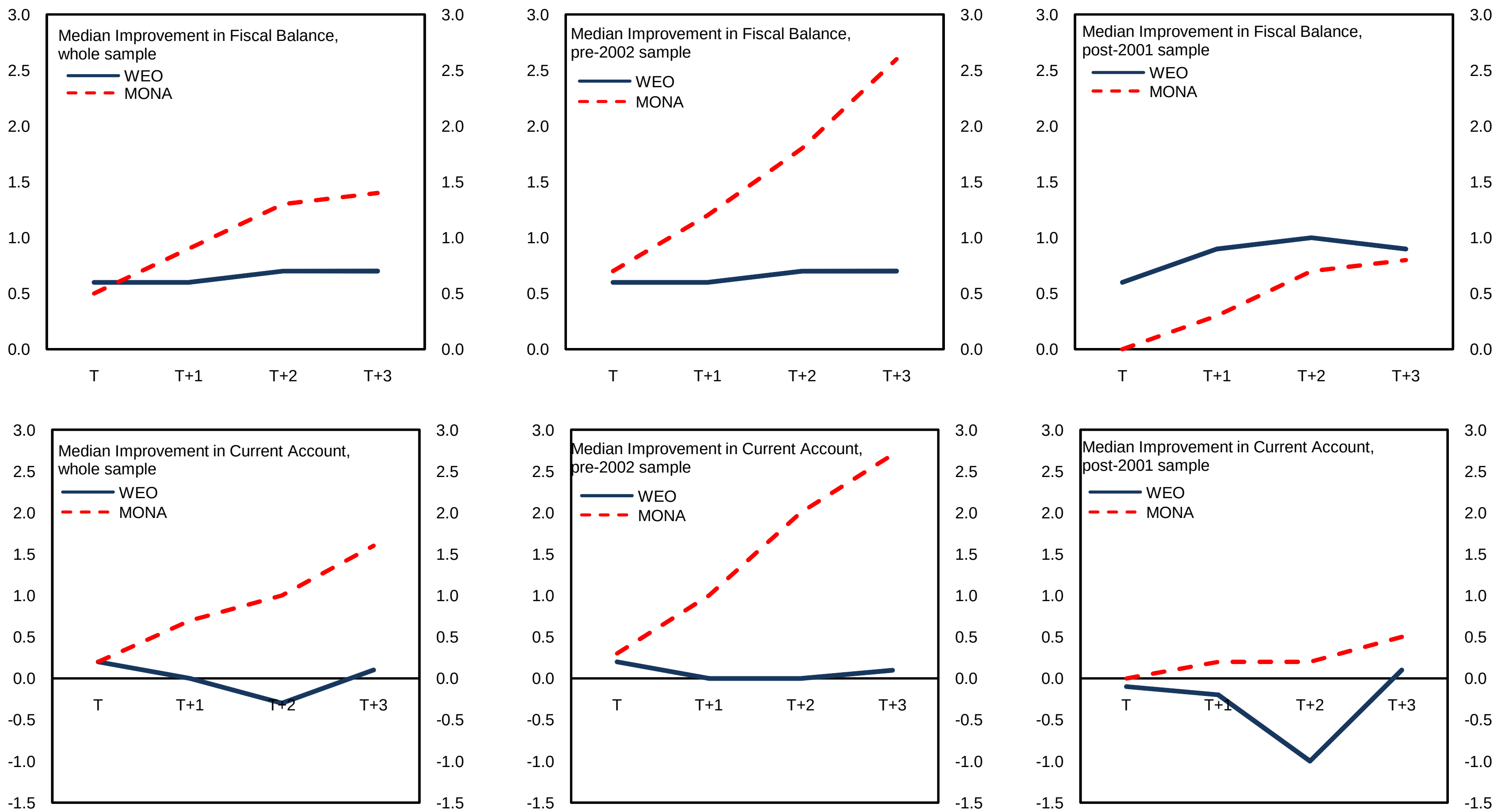
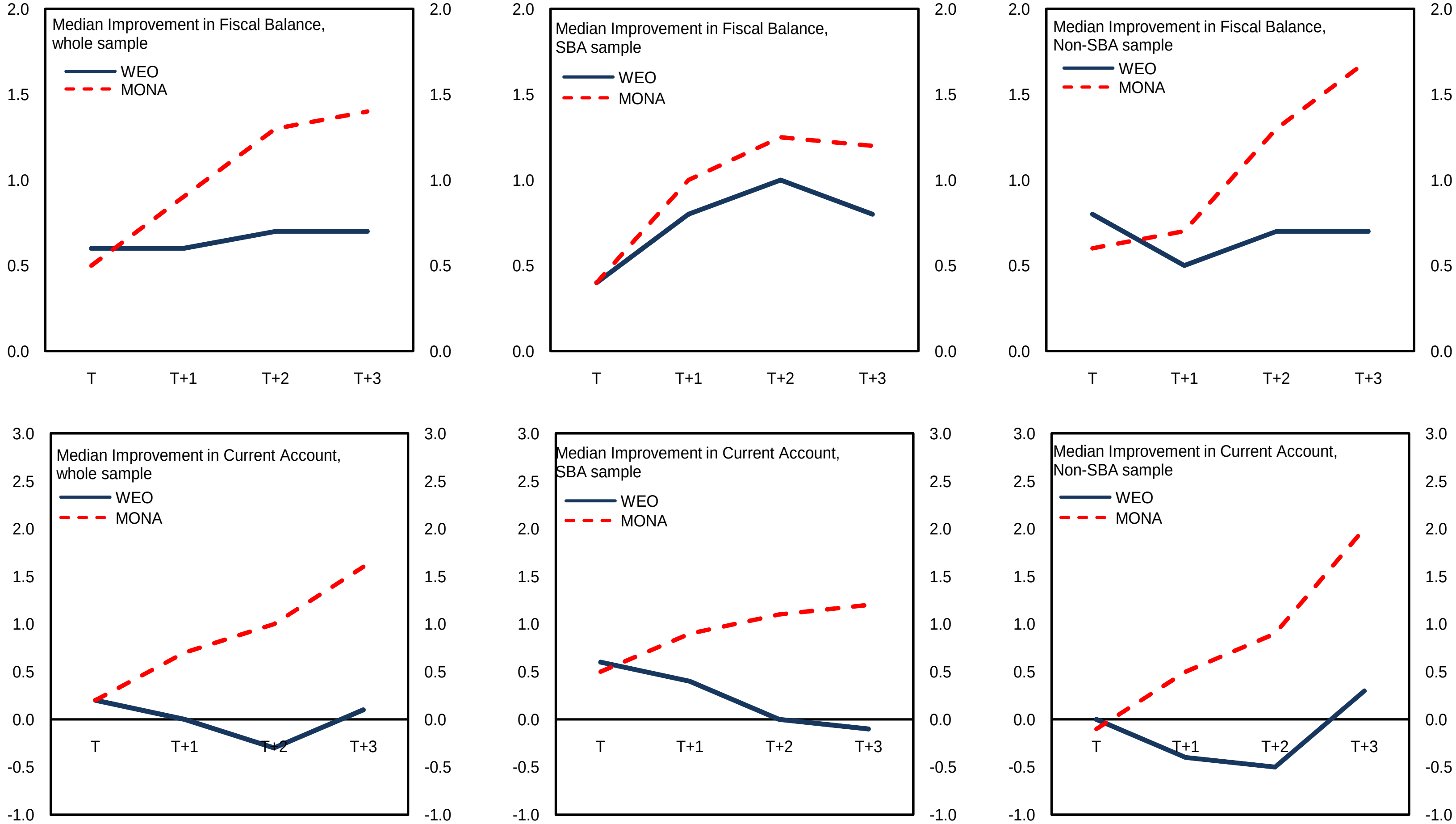


Figure 2. Forecast vs. Actual: Comparison of Current Account Deficit and Fiscal Balance by Time Period
(In percent of GDP)



Source: WEO and MONA databases.

Figure 3. Forecast vs. Actual: Comparison of Current Account Deficit and Fiscal Balance by Program Type
(In percent of GDP)



Source: WEO and MONA databases.

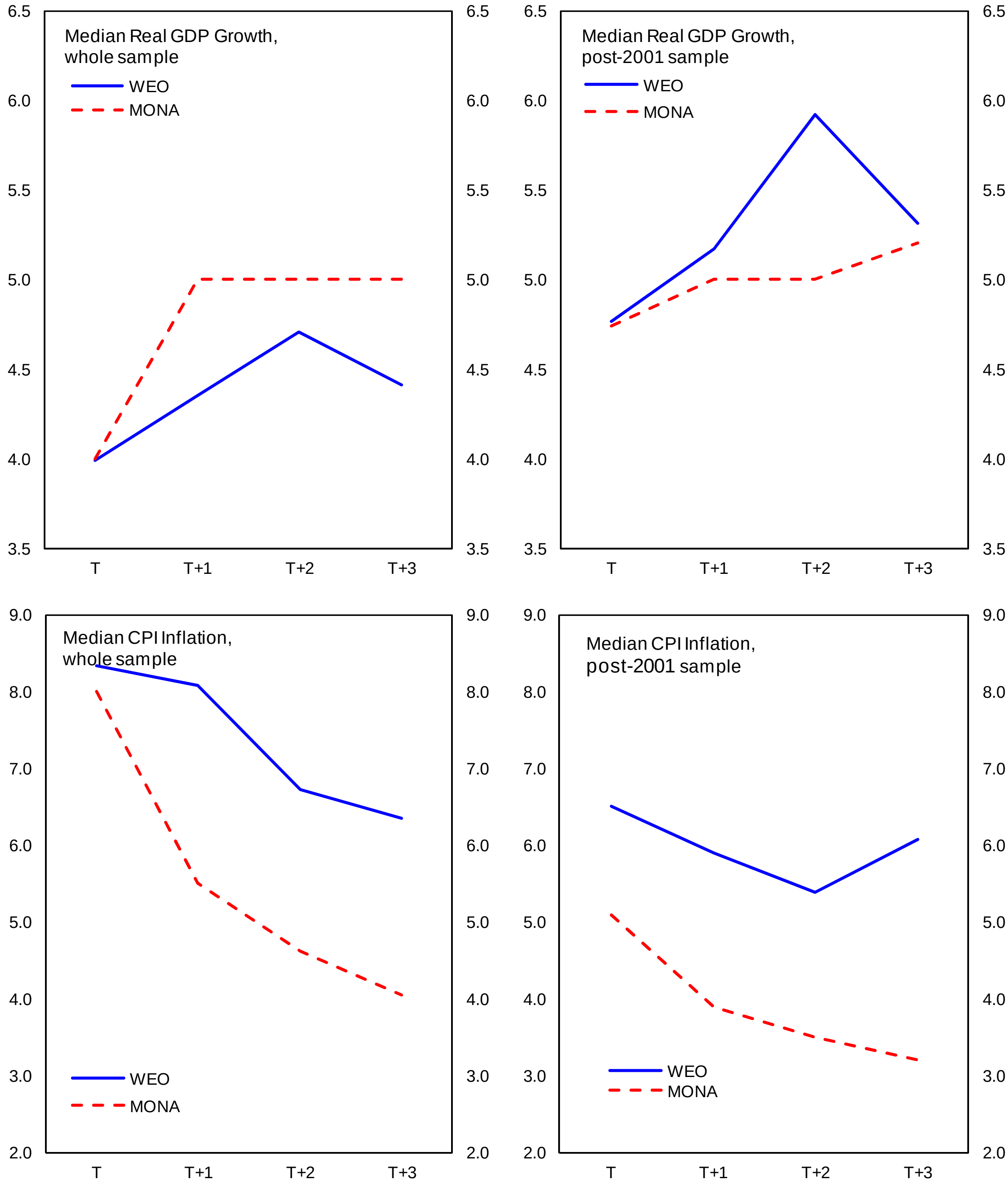
Appendix I. Projected and Actual Economic Growth and CPI Inflation

In the full sample, the growth rate for horizon T is nearly identical in forecast and actual at about 4 percent (Figure A1). For longer horizons the median forecast economic growth is 5 percent, while the actual annual growth rates observed for those countries were high (above 4 percent) but less than the forecast. The IMF median forecast of economic growth post-2001 was less than the actual median growth rate for all horizons, in sharp distinction to the result for the entire sample.

Both forecast and actual begin from a median inflation rate around 8 percent (Figure A1). The forecast rate falls monotonically to 4 percent by horizon T+3, while the actual rate falls at a slower pace, ending at just above 6 percent at horizon T+3. The IMF median forecast of annual inflation was less than the median actual inflation rate both in the full sample and post-2001. The rates for both actual and forecast are lower post-2001, but the relative position of the two remained unchanged.

Table A1 reports the results of a simple autoregressive, mean-reverting, model of economic growth. The three sets of columns report the results of different specifications. All include time-specific effects, but the second set of columns includes country-specific effects while the third set of columns includes the impact of exchange-rate and government expenditure policy as well. As is evident in comparing the two sets of coefficients, the MONA "model" and the WEO "model" exhibit very similar characteristics. The similarity is surprising, especially since both forecast and actual include a significant negative coefficient on the lagged first difference. This may be an illustration of the "Ashenfelter dip" associated with program participation as discussed in Conway (1994).

Figure A1. Forecast vs. Actual: Real GDP Growth and CPI Inflation
(In percent)



Source: WEO and MONA databases.

Table A1: **Projected and Actual Economic Growth**

	Δy_t	$\Delta \hat{y}_t$		Δy_t	$\Delta \hat{y}_t$		Δy_t	$\Delta \hat{y}_t$
Constant	-2.50	-0.43					-1.59	-0.28
	(1.47)	(1.04)					(3.06)	(2.25)
Δy_{t-1}	**-0.76**			**-0.79**			**-0.88**	
	(0.05)			(0.07)			(0.09)	
$\Delta \hat{y}_{t-1}$		**-0.76**			**-0.70**			**-0.73**
		(0.04)			(0.06)			(0.07)
y_{t-1}	**-0.70**			**-0.67**			**-0.82**	
	(0.04)			(0.06)			(0.10)	
$\hat{y}_{t-1}$		**-0.72**			**-0.70**			**-0.76**
		(0.04)			(0.06)			(0.08)
Δe_{t-1}							-0.12	-0.10
							(0.40)	(0.32)
Δu_{t-1}							0.08	0.14
							(0.10)	(0.10)
Time Effects	Y	Y		Y	Y		Y	Y
Country effects	N	N		Y	Y		Y	Y
N	266	266		266	266		256	256
R^2	0.56	0.71		0.71	0.73		0.73	0.75
F	**17.80**	**33.26**		**3.53**	**6.86**		**3.54**	**3.99**