# Projecting Macroeconomic Adjustment in IMF-Supported Programs

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**Abstract**
IMF-supported programs contain projections of the evolution of several macroeconomic variables. 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 175 programs approved in the period 1993-2001. We focus on the projections of two macroeconomic aggregates-specifically, on 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 four potential reasons for divergence of projected from actual values: (i) mismeasured data on initial conditions; (ii) differences between the "model" underlying the IMF projections and the "model" suggested by the data on outturns; (iii) differences between reforms/measures underlying the projections and those actually undertaken; and (iv) random errors in the actual data. Our data analysis suggests that all are important, but that the incomplete information on initial conditions is the largest contributor to discrepancies between projection and actual.

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In this paper, we examine the accuracy of IMF projections associated with 175 IMF-supported programs approved in the period 1993-2001. For each program, the IMF staff prepares a projection of the 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.[1] We focus upon the projections of macroeconomic aggregates – specifically, on the ratios of fiscal surplus to GDP and of current-account surplus to GDP – during the years immediately following the approval of the IMF program. We will compare these projections to the actual data for the same years.

Our comparison is statistical. We begin with descriptive statistics for the two macroeconomic aggregates, and demonstrate that the projection deviates substantially from the observed. We then use a simple vector autoregressive model of the determination of these two aggregates to decompose the deviation into components. We find that the "model" revealed by IMF staff's projections differs significantly from the model evident in historical data. We also find, however, that a substantial amount of the deviation in projections from historical is due to the incomplete information on which the IMF staff base its projections. We provide summary indicators of our results in this paper; for more detailed discussion, and for an analysis of the importance of staff revisions of projections, see Atoian, Conway, Selowsky and Tsikata (2003).

The data we analyze come from two distinct sources. The projections (also called "envisaged" outcomes) are drawn from the Monitoring of Arrangements (MONA) database maintained by the IMF.[2] The data on historical outcomes are drawn from the "World Economic Outlook" (WEO) database of the IMF as reported in June 2002. Given the difference in sources, some data manipulation is necessary to ensure comparability.[3] The data are redefined in each case to be relative to the initial program year: it is denoted the "year T" of the program.[4]
We will examine four projection "horizons" in this study. For each projection horizon, we will compare the IMF staff projection with the historical outcome. We 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

[1] 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.

[2] When an IMF program is approved, the IMF staff uses the best statistics available at that time for current and past macroeconomic data to create projections for the evolution of those variables over the following years. These projections represent the "original program" projections for that IMF program. Program performance is reviewed periodically over time, and at each review the IMF staff creates a new set of projections for the macroeconomic data reflecting the best available information of that time. These revisions are not included in this study, but are addressed in Atoian, Conway, Selowsky and Tsikata (2003).

[3] For example, the projections are reported on an annual basis but the year is not invariably a calendar year. For some programs, the fiscal year was used as the basis of data collection and forecasting. In those instances, the historical data are converted into fiscal-year equivalents through weighted-average conversion of the calendar-year data.

[4] 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. .

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 observations available for comparisons is as follows for the four horizons: 175, 147, 115 and 79 for horizons T through T+3.

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 $y_{jt}$. The historical current-account surplus as a share of GDP will be denoted $c_{jt}$. The projections of these two variables will be denoted $\hat{y}_{jt}$ 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 $\Delta\hat{y}_{jk}$ 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, $\Delta\hat{c}_{jT} = \hat{c}_{jT} - \hat{c}_{jT-1}$ . Historical data from WEO are differenced analogously.

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.

## I. What Does The Record Show?

For an initial pass, we compare the 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 mean of $\Delta\hat{y}_{jk}$ and $\Delta\hat{c}_{jk}$ for various projection horizons k with the mean of the actual $\Delta y_{jk}$ and $\Delta c_{jk}$, we find that projections differ substantially from those actually observed. Figure 1 illustrates the pattern of mean changes in projected and historical fiscal ratios.[5] The two mean changes are nearly coincident for horizon T, while for longer horizons the historical and envisaged changes diverge sharply. The mean projected change in the fiscal ratio rises with the length of the horizon; at horizon T+3, the projected change in the fiscal ratio is 3.5 percentage points. The change actually observed over those time horizons was quite different; 0.68 percentage points for horizon T+1 and up to 1.12 percentage points for horizon T+3.

Figure 2 illustrates the pattern for changes in projected and actual current-account ratios. The mean projected change in the current-account ratio is negative for horizon T and horizon T+1. The change becomes positive and growing for longer projection horizons. The historical change in current-account ratio for participating countries followed a different dynamic: improvement for horizon T, followed by deterioration in longer horizons. Negative changes in mean current-account ratio continued three and four years after adoption of the IMF program.

[5] The data on which Figures 1 and 2 are based are reported in Table 1.

While these mean differences are suggestive, they cover up the great variability in projections and realizations for both ratios. As Table 1 reports, for both historical and envisaged observations the standard error is at least as large as the mean effect. In the correlations between projected and historical changes of the two ratios over the various time horizons, we observe

| Horizons: | T | T+1 | T+2 | T+3 |
|---|---|---|---|---|
| Fiscal ratio ($\Delta y_{jk}$, $\Delta\hat{y}_{jk}$) | 0.61 | 0.56 | 0.31 | 0.56 |
| Current account ratio ($\Delta c_{jk}$, $\Delta\hat{c}_{jk}$) | 0.54 | 0.38 | 0.32 | 0.38 |

There is a good, though not perfect, correlation between projected and historical changes for horizon T. For longer projection horizons the correlation is lower. The horizon T+2 correlations exhibit the lowest values, with horizon T+3 correlations rising again to equal those of T+1.

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. It will be useful, however, to decompose the projection error into parts – can we learn from the record to identify the source of the projected imprecision?

**II. Decomposing Projection Error.**

Begin with $g_T$, a macroeconomic variable observed at time T. Define $s_T$ as the vector of policy forcing variables observed at time T. Denote the projection of $\Delta g_T$ 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.[6] 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 $\zeta_{T-1}$ 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 $\phi$ the true reduced-form model. Projection error can then be represented by the difference ($\Delta\hat{g}_T$ - $\Delta g_T$).[7]

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

There are four potential sources for this projection error. First, the projection model f(.) may not be identical with the true model $\phi$(.). Second, the historical policy adjustment ($\Delta s_T$) may differ from the projected policy adjustment ($\Delta\hat{s}_T$). Third, the information set $X_{T-1}$ available for the

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6 By contrast, we consider the forecast of $\Delta g_T$ 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.

7 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.

projections may not include the same information as the forcing vector $\zeta_{T-1}$ 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 $g_{T-2}$.[8] The policy matrix is represented by the single instrument $s_T$. Equations (1) and (2) can then be rewritten in the following form:

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

$$\Delta g_T = \alpha_1\, \Delta g_{T-1} + \alpha_2\, g_{T-1} + \beta_1\, \Delta s_T + \varepsilon_T \qquad (2e)$$

The coefficients ($\alpha_1$, $\alpha_2$, $\beta_1$) 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 $\eta_{T-1}$ 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 $\varepsilon_T$ represents the stochastic nature of realizations of the actual variable.

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

$$b_1(\Delta\hat{s}_T - \Delta s_T) + [a_2\, \eta_{T-1} + a_1\, (\Delta\hat{g}_{T-1} - \Delta g_{T-1})] + \varepsilon_T \qquad (3e)$$

The projection error thus illustrates the four components mentioned above. First, there is the possibility that the forecaster's model differs 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 of variable growth. 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/GDP ratio and the current account balance/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 differences in models, differences in initial conditions, differences in policy response, or simply random variation in the historical data.

**Fiscal and current accounts.**
Begin with the macro identity:

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[8] $g_{T-2}$ enters the expression through the term $\Delta g_{T-1}$.

$$y_{jt} \equiv c_{jt} - p_{jt} \tag{4}$$

holding for all countries j and time periods t. $y_{jt}$ 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 saving as a share of GDP.

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 saving opportunities and private saving.

$$p^n_{jt} = \alpha_j + \beta_t + \delta\, c_{jt} \tag{5}$$

Combining (4) and (5), and defining $e_{jt} = (p_{jt} - p^n_{jt})$ as the excess private saving in any period, yields

$$y_{jt} = -\,\alpha_j - \beta_t + (1-\delta)\, c_{jt} - e_{jt} \tag{6}$$

The variables $y_{jt}$ and $c_{jt}$ can be represented by a vector autoregression. With appropriate substitution, this vector autoregression can be rewritten in error-correction form.[9]

$$\Delta y_{jt} = a_o - a_{12}\, \Delta y_{jt-1} - b_{12}\, \Delta c_{jt-1} + (a_{11}+a_{12}-1)\, y_{jt-1} + (b_{11} + b_{12})c_{jt-1} + \varepsilon_{yjt} \tag{8a}$$

$$\Delta c_{jt} = b_o - a_{22}\, \Delta y_{jt-1} - b_{22}\, \Delta c_{jt-1} + (a_{21}+a_{22})\, y_{jt-1} + (b_{12}+b_{22}-1)c_{jt-1} + \varepsilon_{zjt} \tag{8b}$$

There is in general no way to assign contemporaneous causality in (8a) and (8b). If it were possible to assert that the current-account ratio is exogenously determined, for example, then the

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[9] 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.

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

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

Specification tests are used to choose the lag length appropriate to the empirical work. In a world in which $y_{jt}$ and $c_{jt}$ are non-stationary but are cointegrated on a country-by-country basis, further simplification is possible. If $y_{jt}$ and $c_{jt}$ are non-stationary in the current dataset, then equation (6) represents a cointegrating relationship. The "error correction" variable $e_{jt}$ can then be inserted in the equations (8) in place of the terms in $y_{jt-1}$ and $c_{jt-1}$ and will have the coefficient associated with $y_{jt-1}$ in (8). 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 $\Delta y_{jt}$ equation. Hamilton (1994, chapter 19) provides a clear derivation of this error-correction form from the underlying autoregression.

contemporaneous change $\Delta c_{jt}$ could be a separate regressor in the $\Delta y_{jt}$ equation to account for that contemporaneous correlation.

The econometric effects modeled here can be divided into three groups. The first group, represented by the terms in $\Delta c_{jt-1}$ and $\Delta y_{jt-1}$, capture the autoregressive structure of the system. The second group, represented by the terms in $y_{jt-1}$ and $c_{jt-1}$, capture the adjustment of these variables in response to deviations from the "normal" relationship described in (6). The third group represents random errors. Although the direction of contemporaneous causality cannot be verified, there is a version of dynamic causality that can be checked. The coefficients of $y_{jt-1}$ and $c_{jt-1}$ represent the degree to which the current-account and fiscal ratios respond to deviations from the norm.

The system of equations in (8) 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 messy, to introduce them. One way to do so will be through definition of a policy response function, by which $\Delta s_{jT}$ is itself a function of $c_{jT-1}$ and $y_{jT-1.}$ The second will be to incorporate the policy variables as exogenous forcing variables. The approach we use will incorporate parts of each.

**Estimation using historical data.**
The results of Table 2a summarize the coefficient estimates from equations (8) for all programs in the sample at horizon T using historical data. Specification testing revealed that lagged first-difference terms with lag length greater than two did not contribute significantly to the regression.[10] 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.[11] The error-correction term ($e_{jT-1}$) was derived from the regression in levels (i.e., not first-differenced) reported in Annex A.

For the ratio of fiscal balance to GDP, the estimation results suggest the following insights in the first two columns of Table 2a:

- There is significant positive contemporaneous correlation between the two variables, and the normalization chosen here assigns causation to $\Delta c_{jT}$. For a one percent increase in the current-account ratio, there is a 0.28 percent increase in the fiscal ratio.
- The current first-difference responds positively and significantly to shocks in the own ratio in previous periods. For a unit shock to $\Delta y_{jT-1}$, there is other things equal a 0.25 increase in $\Delta y_{jT}$. For a unit shock to $\Delta y_{jT-2}$, the transmitted shock is positive and significant at 0.16. Past positive current-account shocks have small negative effects on $\Delta y_{jT}$ with the two-period lagged effect significant at the 90 percent level of confidence.
- The coefficient on $y_{jt-1}$ is significantly different from zero, but not 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 82 percent of that deviation.

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[10] 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.
[11] 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.

For the ratio of current account to GDP, the estimation explains a lower percentage of the variation (as indicated by the $R^2$ statistic of 0.56). The second set of columns reports coefficients and standard errors for that specification, and indicates:

- The lagged first-difference terms have no significant effect on the current first-difference.
- The coefficient on $c_{jT-1}$ of –0.40 is significantly different from both zero and negative one. It indicates that 40 percent of any deviations of the current account ratio from its normal value is made up in the following period.

The last four columns of Table 2a report the results of error-correction regressions in which the $y_{jT-1}$ and $c_{jT-1}$ are replaced by $e_{jT-1}$ from equation (6), as implied by a cointegrating relationship between the two variables. As is evident in comparing the first set and third set of results, the cointegrating relationship captures nearly all the explanatory power in the $\Delta y_{jT}$ regression. The cointegrating relationship is less effective in the $\Delta c_{jT}$ equation, however, as indicated by the $R^2$ statistic.[12]

These results are specific to the data for horizon T. When horizon T+1 is considered, we obtain the results in Table 2b. The construction of these data differs somewhat, in that the endogenous variable is a two-period forecast; we chose to use two-period lags on the right-hand side of the equation for comparability. For horizon T+1, the contemporaneous effect of the current account ratio on the fiscal ratio is halved – this is perhaps due to the doubling of the length of the time horizon. The autoregressive structure of the fiscal ratio, significant in horizon T, is no longer significant for horizon T+1. By contrast, the lagged "level" effects have larger coefficients. This effect in the current-account ratio equation is significantly larger, as well, with the coefficient (–0.833) more than double the comparable term for horizon T (-0.40).

**Estimation using the projected data**.
If we interpret the estimated model of the preceding section to be the "true" model (2), we posit that the model used in forming projections for IMF programs should have a similar form. We can use similar econometric techniques to those of the previous section to derive the economic model implied by the projections. We report the results of this estimation exercise in Table 3a for projection horizon T.

The results from estimating the projection model for the fiscal ratio are reported in the first set of columns in Table 3a.

- There is significant contemporaneous correlation between the projected fiscal and current-account ratios. For a one percentage-point increase to the current account ratio, there is evidence of a 0.15 percentage-point increase in the fiscal ratio. This is roughly half of the response found in the actual data. By implication, the IMF staff model will project a 0.85 percentage-point increase in the ratio of private net saving to GDP in response to such a current-account shock, while the historical data indicate a 0.72 percentage-point increase in the private saving ratio in response to such a shock.

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[12] While imposition of the cointegration condition through the error-correction variable is effective for the fiscal ratio, our comparison of projections with historical data will be based upon the system without this condition imposed. As Clements and Hendry (1995) demonstrate, the imposition of the cointegration condition in estimation when cointegration exists improves forecast accuracy most notably for small (i.e., N=50) samples. For larger samples, the improvements in forecast accuracy are small.

- A one percentage-point increase in last period's fiscal ratio will trigger a 0.15 percentage-point decrease in this period's ratio. This suggests the projection is relying on fiscal policy correction to overcome any inertia in fiscal stance over time and to offset past excesses with current austerity.[13] This response also is less than was observed in the historical data.
- There is evidence of an error-correction effect in the data. The coefficients on the lagged ratios have the correct signs, and that associated with $\hat{y}_{jT-1}$ is significantly different from zero. The coefficient –0.44 indicates that the projection is designed to make up 44 percent of any deviation of fiscal ratio from the country's "normal" ratio within a single year. This adjustment is also roughly half of the adjustment observed in the historical data.

The results from estimating the projection model for the current-account ratio are reported in the second set of columns in Table 3a.

- There is no significant evidence of an autoregressive structure in $\Delta c_{jt}$ , just as was true in the historical analysis.
- Past shocks to the fiscal ratio have a significant lagged effect on the current account ratio, a feature unobserved in the actual data.
- There is a significant error-correction effect as evidenced by the coefficient on $\hat{c}_{jT-1}$. The coefficient –0.33 indicates that the projection is constructed to make up about 1/3 of any deviation of the current-account ratio from its normal value within a single year. The coefficient on $\hat{y}_{jT-1}$ is insignificantly different from zero. These features are quite similar to those observed in the historical data.

When the envisaged data are examined with cointegrating relationship imposed, the evidence is once again stronger for the fiscal ratio. In that regression, reported in the third set of columns, the cointegrating variable ($em_{jT-1}$) has explanatory power nearly equal to the lagged $\hat{c}_{jT-1}$ and $\hat{y}_{jT-1}$ reported in the first set of columns. In the equation for the current account ratio, the results are much weaker.

For time horizon T+1, we observe the outcomes of Table 3b. For these envisaged changes, the projection "model" for horizon T+1 is quite similar to that of horizon T. The contemporaneous and lagged "level" effects are almost identical for the fiscal ratio, as is the lagged "level" effect for the current-account ratio. The autoregressive terms differ somewhat, but the differences are not statistically significant. The similarity of error-correction effects is quite striking, as it suggests that the projected adjustment from imbalance occurs totally in horizon T – there is no further adjustment in horizon T+1. This is quite different from the historical record, where adjustment continues in fairly equal increments from horizon T to horizon T+1.

**Divergence between projected and actual policy**.
We note from the preceding discussion that there is substantial evidence of difference between the coefficients in Tables 2a and 3a, and between Tables 2b and 3b. We interpret these

[13] We would observe this negative coefficient, for example, if we had a model that required the government to balance its budget over each two-year period. There could be excess spending in odd years, but it would be offset by spending cuts in even years.

differences as evidence that the "model" used in IMF projections and the "model" generating the historical data are significantly different. However, as the earlier discussion demonstrated, model differences are only one source of projection errors. In this section, we use the framework of equation (3e) to decompose the observed projection error for horizon T into components.

As the earlier discussion indicated, the projection error can conceptually be decomposed into four parts: differences in models, differences in policy response, mismeasurement of initial conditions at time of projection, and random errors. Projection error is measured directly as the projection of the variable for horizon T minus the realization of the variable. Errors in initial conditions are measured as the difference between projected and historical observations of the level of the variable in period T-1. Two policy variables are considered as indicators of the importance of policy-reform conditions in the error: the difference between projected and historical depreciation of the real exchange rate ($\Delta\hat{e}_{jT} - \Delta e_{jT}$) and the difference between projected and historical change in government consumption expenditures as a share of GDP ($\Delta\hat{w}_{jT} - \Delta w_{jT}$).[14] We hypothesize that the former should have a significant effect on the current account, while the latter should be a significant component of the fiscal surplus.

Estimation of (3e) using the error-correction framework presented in equations (8) is complicated by the simultaneity of the macroeconomic balances and the policy variables over which conditions are defined. As (3e) indicates, ($\Delta\hat{e}_{jT} - \Delta e_{jT}$), ($\Delta\hat{w}_{jT} - \Delta w_{jT}$), $\Delta e_{jT}$ and $\Delta w_{jT}$ will all be included as regressors in the estimation framework, but all of these are potentially simultaneously determined with the macro balances. We address this by estimating the equations with both OLS and 2SLS, with the 2SLS results presumed to be free of simultaneity bias.[15] For each equation, as implied by (6), year-specific dummy variables is included to control for year-to-year differences in capital availability on world markets; we also include significant country-specific dummy variables to control for abnormally large cross-country differences in macro balances. Those results are reported in Table 4. The top panel reports the results of regressions in the current-account ratio and the fiscal ratio. There are two columns: the first with OLS estimates, on a slightly larger sample, and the second the 2SLS estimates on a consistent-size sample of 162 observations across all variables. The bottom panel reports the regressions that served as the "first stage" of the 2SLS. The first column reports OLS over the largest sample for which data were available for that regression, while the second column reports OLS results over the consistent 2SLS sample of 162 observations.

We interpret the results as follows. Take as example the coefficient on $c_{jT-1}$ in the two regressions. Given our derivation in (3e), this coefficient should represent the difference between the projection coefficient and the actual coefficient. When we compare the results of Tables 2 and 3, we find this to be the case. Consider the 2SLS results. In the fiscal ratio regression of Table 4, the coefficient of –0.11 is quite similar to the difference (0.08-0.16) of the

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[14] The variable for government consumption expenditures is available in consistent format in both historical and envisaged data. The variable on real depreciation is constructed in both cases as nominal depreciation minus CPI inflation for the horizon in question. These variables are explicit in the historical data. In the envisaged data, the nominal exchange rate is derived as the ratio between GDP in home currency and GDP in US dollars.

[15] Both sets of results are reported because the systems approach to estimation reduces the number of observations usable in estimation. The OLS results thus provide a more comprehensive analysis, although potentially tainted by simultaneity bias.

coefficients reported in Tables 2a and 3a. For the current-account ratio, the coefficient of 0.04 is also very similar to the difference (-0.33-(-0.40)) of the coefficients reported in Tables 2a and 3a. A positive coefficient in this regression indicates that the projection incorporated a more positive response to that variable than was found in the actual data.

We separate the discussion into the various types of errors.

*Differences in modeling*. If the projections used a different model from that evident in the actual data, we expect to find significant coefficients on the variables $c_{jT-1}$, $y_{jT-1}$, $\Delta c_{jT-1}$, $\Delta y_{jT-1}$, $\Delta e_{jT}$ and $\Delta w_{jT}$ in the top panel. Our discussion of Tables 2a and 3a indicated that we anticipated greater evidence of differing models in the fiscal projections than in the current-account projections. This point is partially supported by results reported in Table 4. Consider the OLS results. In the fiscal-ratio estimation, there are significant coefficients on $c_{jT-1}$ (-0.11), $\Delta e_{jT-1}$ (0.01), $\Delta y_{jT-1}$ (-0.08) and $\Delta w_{jT}$ (0.10). If we consider the last case for illustration: a positive $\Delta w_{jT}$ should reduce the fiscal balance. The coefficient (0.10) indicates that the IMF projections incorporated less passthrough of increased government expenditures into reduced fiscal ratio than was actually observed, leaving a positive projection error. However, the 2SLS results suggest that differences in modeling are less apparent than it is suggested by the OLS estimates since only the coefficient on $c_{jT-1}$ (-0.10) is significantly different from zero.

For the current-account ratio, there is no significant evidence of differences in modeling. All coefficients on these variables are both small and insignificantly different from zero.

*Mismeasurement of initial conditions*. Another source of projection error will be the difference between the initial conditions known to IMF forecasters and the actual initial conditions available in historical data. For these differences to be a significant source of projection error, the coefficients on the variables $(\hat{c}_{jT-1} - c_{jT-1})$ and $(\hat{y}_{jT-1} - y_{jT-1})$ must be significantly different from zero.

In the fiscal-ratio regression, the difference in initial fiscal ratios $(\hat{y}_{jT-1} - y_{jT-1})$ is a significant contributor to projection error. The coefficient (-0.30) indicates that when the IMF forecaster had access to artificially high estimates of the previous-period fiscal ratio, she adjusted downward the projected policy adjustment necessary. This forecast response was a rational one, given the error-correction nature of the fiscal ratio, but was based upon an incorrect starting point.

In the current-account ratio regression, the differences in initial conditions are the only significant determinants of projection error. With coefficients (-0.31) for $(\hat{c}_{jT-1} - c_{jT-1})$ and (-0.25) of $(\hat{y}_{jT-1} - y_{jT-1})$, the regressions suggest that the projections were in error largely because of incomplete information about the true value of the current account ratio in the preceding period.

*Differences in policy response*. If the projections included a policy response at variance with that actually observed, then the coefficients on $(\Delta\hat{w}_{jT} - \Delta w_{jT})$ and $(\Delta\hat{e}_{jT} - \Delta e_{jT})$ will be significant in the two regressions. In both the 2SLS and the OLS results there is little evidence of this. In the fiscal regression, there is a significant coefficient (-0.47) on $(\Delta\hat{w}_{jT} - \Delta w_{jT})$. This indicates that when the IMF projected smaller expenditure increases than actually occurred, the projection error on the fiscal ratio was on average positive – as expected.

The regressions in the bottom panel hold some clues as to why the projections differed from historical. As is evident in the ($\Delta\hat{w}_{jT}$ -$\Delta w_{jT}$) regression, previous forecast errors were significant determinants of this policy projection error, as was a bias toward more positive projections as the previous-period fiscal ratio rose. The policy projection errors in the real exchange rate depreciation ($\Delta\hat{e}_{jT}$ -$\Delta e_{jT}$) had no significant contribution to either regression in either specification.

*Random errors*. As the $R^2$ statistics indicate for the two regressions, the preceding three sources of projection error explain only 59 percent (for the current account ratio) and 71 percent (for the fiscal ratio) of total projection error. The remainder should be considered random shocks.

**IV. Accuracy of estimates.**

Musso and Phillips (2001) suggest evaluating projection accuracy by comparing projected values with a random-walk benchmark projection. Applying their approach to our exercise, we investigate whether the IMF projections of the year-T and year-T+1 values of the variables outperform "random walk" projections – i.e., projected value set equal to the T-1 value. We draw our conclusions from Theil's U statistic and report results in Table 5.[16] Larger values of the U statistic indicate a poorer projection performance.

For the fiscal balance, IMF projections perform significantly better than the random walk for both considered projection horizons. While relative gain in projection performance of MONA projections vis-à-vis the random-walk benchmark decreases from approximately 18 percent for year-T level to 15 percent for year-T+1, the difference still remains quite substantial.

For the current account, only the year-T projection outperforms the random-walk benchmark. For the T+1 horizon, IMF projection performance for this variable is about 3 percent worse than that the random-walk benchmark.

As one would expect, the overall projection performance decreases as the length of projection horizon increases, which is reflected in larger values of U statistic for the year-T+1 projections. This observation is valid for both variables and for both types of projections.

**V. Conclusions and extensions.**

Envisaged and historical observations on the fiscal and current-account ratios in countries participating in 175 IMF programs between 1993 and 2001 deviated strongly from one another. Our statistical analysis suggests that the causes can be separated into four components.

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[16] The Theil's U Statistic: $U = \sqrt{\dfrac{1/N \sum_{jt} (g_{jt} - \hat{g}_{jt})^2}{1/N \sum_{jt} g_{jt}^{\,2}}}$

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 leads to substantial divergence even if the IMF staff used the 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, the IMF staff did appear to have a different model in mind when making its forecasts. Its model was characterized by gradual fiscal-account adjustment, both in response to contemporaneous current-account shocks and to long-run imbalances, while the model revealed by historical data was characterized by more rapid adjustment to both types of imbalances. Further, its envisaged response was concentrated in horizon T, while the historical response to shocks was roughly equally proportioned across horizons T and T+1.

Third, there is a difference between projected and historical implementation of policy adjustment. Given the level of aggregation of the policy variables investigated (total government consumption expenditures, real exchange rate depreciation) we cannot conclude that the difference is due to a failure to meet the conditions of the program; the differences could also be due to shocks that worsened performance of these aggregates even when conditions were fulfilled. This conclusion is contingent upon our choice of “policy variable”. Here, we use government consumption expenditures and real exchange rate depreciation. If we had chosen the fiscal surplus as a “policy variable” rather than outcome, the results of this paper suggest that our conclusions would be reversed. This is a question that can be, and should be, investigated further.

Fourth, there is ample evidence that IMF projections, as with other macroeconomic projections, are quite inaccurate. The evidence on “accuracy” reported here is instructive – while the projections outperform a random walk most of the time, they are not much better. The Meese and Rogoff (1980) results remind us of the difficulty in projecting exchange rates in time series. The project described here indicates the inaccuracy of simple models in a panel (i.e., time series and cross section of countries) format.

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.

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**Figure 1: Mean Historical and Projected Changes in Fiscal Ratios**

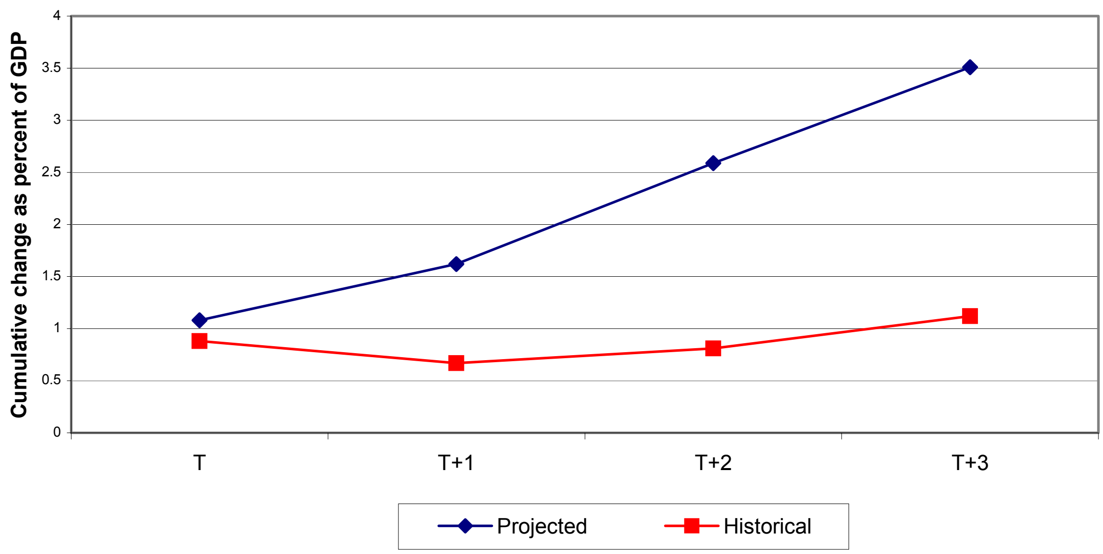
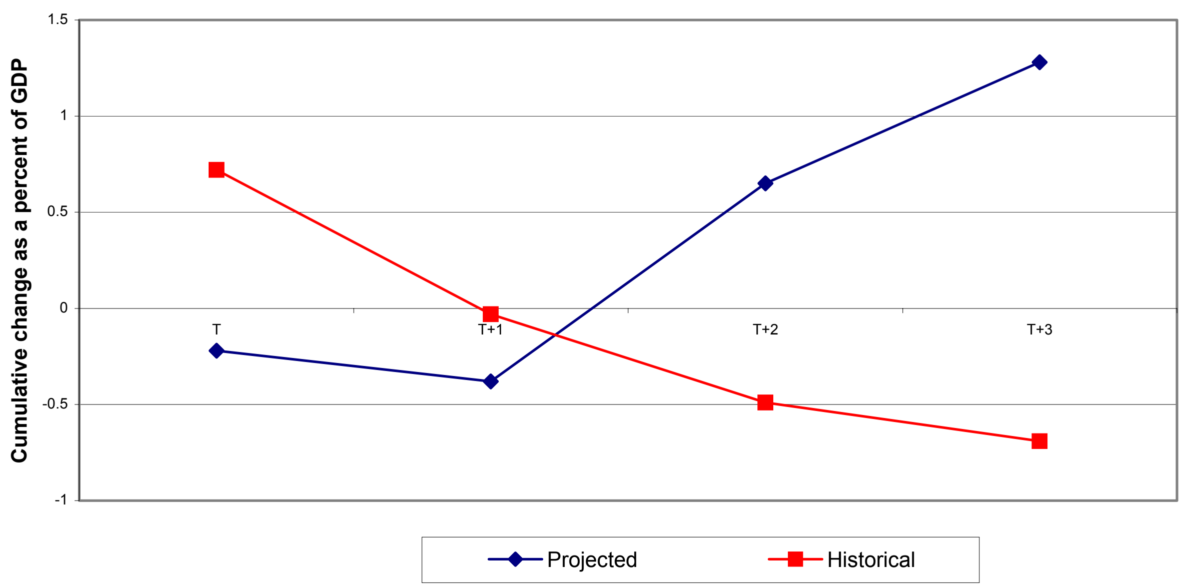



**Figure 2: Mean Historical and Projected Changes in Current-Account Ratio**



## Table 1: Projecting the Change in Macroeconomic Aggregates

**Horizon T:**

Simple Statistics

| Variable | N | Mean | Std Dev | Sum | Minimum | Maximum |
|---|---|---|---|---|---|---|
| $\Delta \hat{y}_{jT}$ | 175 | 1.08651 | 2.88011 | 190.14000 | -7.60000 | 12.50000 |
| $\Delta y_{jT}$ | 175 | 0.87778 | 3.25935 | 153.61161 | -11.33896 | 12.72751 |
| $\Delta\hat{c}_{jT}$ | 175 | -0.22187 | 3.47920 | -38.82699 | -13.89236 | 11.66200 |
| $\Delta c_{jT}$ | 175 | 0.72340 | 4.77454 | 126.59449 | -17.68986 | 14.49604 |

Correlations:

| | $\Delta \hat{y}_{jT}$ | $\Delta y_{jT}$ | $\Delta\hat{c}_{jT}$ | $\Delta c_{jT}$ |
|---|---|---|---|---|
| $\Delta \hat{y}_{jT}$ | 1.00000 | | | |
| $\Delta y_{jT}$ | **0.60489** | 1.00000 | | |
| $\Delta\hat{c}_{jT}$ | 0.24256 | 0.12334 | 1.00000 | |
| $\Delta c_{jT}$ | 0.19968 | 0.30303 | **0.53486** | 1.00000 |

**Horizon T+1**

Simple Statistics

| Variable | N | Mean | Std Dev | Sum | Minimum | Maximum |
|---|---|---|---|---|---|---|
| $\Delta \hat{y}_{jT+1}$ | 147 | 1.62408 | 3.22486 | 238.74000 | -5.60000 | 12.90000 |
| $\Delta y_{jT+1}$ | 147 | 0.67722 | 3.93298 | 99.55073 | -19.42935 | 13.69233 |
| $\Delta\hat{c}_{jT+1}$ | 147 | -0.37867 | 4.98040 | -55.66390 | -22.23187 | 12.01531 |
| $\Delta c_{jT+1}$ | 147 | -0.03233 | 7.07135 | -4.75294 | -35.61176 | 25.90529 |

Correlations

| | $\Delta \hat{y}_{jT+1}$ | $\Delta y_{jT+1}$ | $\Delta\hat{c}_{jT+1}$ | $\Delta c_{jT+1}$ |
|---|---|---|---|---|
| $\Delta\hat{y}_{jT+1}$ | 1.00000 | | | |
| $\Delta y_{jT+1}$ | **0.56182** | 1.00000 | | |
| $\Delta\hat{c}_{jT+1}$ | 0.13572 | -0.02165 | 1.00000 | |
| $\Delta c_{jT+1}$ | 0.12453 | 0.04358 | **0.38254** | 1.00000 |

**Horizon T+2**

Simple Statistics

| Variable | N | Mean | Std Dev | Sum | Minimum | Maximum |
|---|---|---|---|---|---|---|
| $\Delta\hat{y}_{jT+2}$ | 115 | 2.59478 | 3.67922 | 298.40000 | -3.30000 | 15.60000 |
| $\Delta y_{jT+2}$ | 115 | 0.81807 | 4.85553 | 94.07814 | -16.72117 | 11.88877 |
| $\Delta\hat{c}_{jT+2}$ | 115 | 0.64742 | 4.64897 | 74.45280 | -22.04280 | 11.68855 |
| $\Delta c_{jT+2}$ | 115 | -0.49056 | 7.32857 | -56.41476 | -38.14743 | 21.78397 |

Correlations

| | $\Delta\hat{y}_{jT+2}$ | $\Delta y_{jT+2}$ | $\Delta\hat{c}_{jT+2}$ | $\Delta c_{jT+2}$ |
|---|---|---|---|---|
| $\Delta\hat{y}_{jT+2}$ | 1.00000 | | | |
| $\Delta y_{jT+2}$ | **0.31046** | 1.00000 | | |
| $\Delta\hat{c}_{jT+2}$ | 0.11603 | -0.21840 | 1.00000 | |
| $\Delta c_{jT+2}$ | -0.03683 | -0.11606 | **0.32365** | 1.00000 |

**Horizon T+3**

Simple Statistics

| Variable | N | Mean | Std Dev | Sum | Minimum | Maximum |
|---|---|---|---|---|---|---|
| $\Delta\hat{y}_{jT+3}$ | 79 | 3.51000 | 4.27596 | 277.29000 | -2.70000 | 19.50000 |
| $\Delta y_{jT+3}$ | 79 | 1.11918 | 4.85320 | 88.41557 | -17.48994 | 13.35470 |
| $\Delta\hat{c}_{jT+3}$ | 79 | 1.28198 | 4.91608 | 101.27681 | -19.89594 | 14.73079 |
| $\Delta c_{jT+3}$ | 79 | -1.37587 | 12.09842 | -108.69398 | -81.569321 | 21.75981 |

Correlations

| | $\Delta\hat{y}_{jT+3}$ | $\Delta y_{jT+3}$ | $\Delta\hat{c}_{jT+3}$ | $\Delta c_{jT+3}$ |
|---|---|---|---|---|
| $\Delta\hat{y}_{jT+3}$ | 1.00000 | | | |
| $\Delta y_{jT+3}$ | **0.55890** | 1.00000 | | |
| $\Delta\hat{c}_{jT+3}$ | 0.14194 | -0.12499 | 1.00000 | |
| $\Delta c_{jT+3}$ | -0.02829 | 0.01113 | **0.38530** | 1.00000 |

Table 2a: **Regression results, historical current and fiscal account ratios, horizon T.**

| | $\Delta y_{jT}$ | | $\Delta c_{jT}$ | | $\Delta y_{jT}$ | | $\Delta c_{jT}$ | |
|---|---|---|---|---|---|---|---|---|
| | Coef | S.E. | Coef | S.E. | Coef | S.E. | Coef | S.E. |
| | | | | | | | | |
| $\Delta c_{jT}$ | 0.28 ** | (0.06) | | | 0.25 ** | (0.05) | | |
| $\Delta y_{jT-1}$ | 0.25 ** | (0.10) | -0.08 | (0.19) | 0.23 ** | (0.10) | -0.04 | (0.20) |
| $\Delta c_{jT-1}$ | -0.05 | (0.05) | -0.04 | (0.10) | -0.02 | (0.05) | -0.23 ** | (0.09) |
| $\Delta y_{jT-2}$ | 0.16 ** | (0.08) | -0.01 | (0.16) | 0.14 * | (0.08) | 0.13 | (0.16) |
| $\Delta c_{jT-2}$ | -0.07 * | (0.04) | -0.02 | (0.08) | -0.05 | (0.04) | -0.17 ** | (0.07) |
| | | | | | | | | |
| $y_{jT-1}$ | -0.82 ** | (0.11) | -0.09 | (0.21) | | | | |
| $c_{jT-1}$ | 0.16 ** | (0.07) | -0.40 ** | (0.12) | | | | |
| | | | | | | | | |
| $e_{jT-1}$ | | | | | -0.81 ** | (0.11) | -0.17 | (0.22) |
| | | | | | | | | |
| N | 176 | | 176 | | 176 | | 176 | |
| $R^2$ | 0.78 | | 0.56 | | 0.78 | | 0.50 | |
| | | | | | | | | |

Full sample, Horizon T. Standard errors (S.E.) in parentheses.
** indicates significance at the 95 percent confidence level, and * indicates significance at the 90 percent level of confidence.
A complete set of time and country dummies were included in the regressions, but their coefficients are suppressed for brevity.

Table 2b: **Regression results, historical current and fiscal account ratios, Horizon T+1.**

| | $\Delta y_{jT+1}$ | | $\Delta c_{jT+1}$ | | $\Delta y_{jT+1}$ | | $\Delta c_{jT+1}$ | |
|---|---|---|---|---|---|---|---|---|
| | Coef | S.E. | Coef | S.E. | Coef | S.E. | Coef | S.E. |
| | | | | | | | | |
| $\Delta c_{jT+1}$ | 0.142** | (0.06) | | | 0.124** | (0.05) | | |
| $\Delta y_{jT-1}$ | 0.093 | (0.11) | -0.145 | (0.24) | 0.079 | (0.10) | 0.012 | (0.26) |
| $\Delta c_{jT-1}$ | -0.036 | (0.07) | -0.115 | (0.16) | -0.006 | (0.06) | -0.547*** | (0.12) |
| | | | | | | | | |
| $y_{jT-1}$ | -1.125*** | (0.17) | 0.474 | (0.37) | | | | |
| $c_{jT-1}$ | 0.230** | (0.10) | -0.833*** | (0.21) | | | | |
| | | | | | | | | |
| $e_{jT-1}$ | | | | | -1.102*** | (0.16) | 0.273 | (0.41) |
| | | | | | | | | |
| N | 147 | | 147 | | 147 | | 147 | |
| $R^2$ | 0.83 | | 0.72 | | 0.83 | | 0.65 | |
| | | | | | | | | |

Variable definition (this table only):

$\Delta g_{jT+1}=g_{jT+1}- g_{jT-1}$

$\Delta g_{jT-1}=g_{jT-1}- g_{jT-3}$

Full sample, Horizon T+1. Standard errors (S.E.) in parentheses.

*** indicates significance at the 99 percent confidence level, ** indicates significance at the 95 percent confidence level, and * indicates significance at the 90 percent level of confidence.
A complete set of time and country dummies were included in the regressions, but their coefficients are suppressed for brevity.

Table 3a: **Regression results, envisaged current and fiscal account ratios, horizon T.**

| | $\Delta\ \hat{y}_{jT}$ | | $\Delta\hat{c}_{jT}$ | | $\Delta\ \hat{y}_{jT}$ | | $\Delta\hat{c}_{jT}$ | |
|---|---|---|---|---|---|---|---|---|
| | Coefficient | S.E. | Coefficient | S.E. | Coefficient | S.E. | Coefficient | S.E. |
| | | | | | | | | |
| $\Delta\hat{c}_{jT}$ | 0.15 * | (0.09) | | | 0.20 ** | (0.08) | | |
| $\Delta\hat{y}_{jT-1}$ | -0.15 | (0.09) | -0.15 | (0.12) | -0.14 | (0.09) | -0.15 | (0.13) |
| $\Delta\hat{c}_{jT-1}$ | -0.09 | (0.06) | -0.0004 | (0.08) | -0.09 | (0.06) | -0.06 | (0.09) |
| $\Delta\hat{y}_{jT-2}$ | -0.03 | (0.08) | 0.16* | (0.10) | -0.05 | (0.08) | 0.11 | (0.11) |
| $\Delta\hat{c}_{jT-2}$ | -0.06 | (0.04) | 0.04 | (0.06) | -0.08 * | (0.04) | -0.04 | (0.06) |
| | | | | | | | | |
| $\hat{y}_{jT-1}$ | -0.44 ** | (0.09) | -0.02 | (0.11) | | | | |
| $\hat{c}_{jT-1}$ | 0.08 | (0.07) | -0.33 ** | (0.08) | | | | |
| | | | | | | | | |
| $em_{jT-1}$ | | | | | -0.44 ** | (0.09) | -0.04 | (0.12) |
| | | | | | | | | |
| N | 165 | | 165 | | 165 | | 165 | |
| $R^2$ | 0.85 | | 0.76 | | 0.85 | | 0.69 | |
| | | | | | | | | |

Full sample, Horizon T. Standard errors (S.E.) in parentheses.
** indicates significance at the 95 percent confidence level, and * indicates significance at the 90 percent level of confidence.
A complete set of time and country dummies were included in the regressions, but their coefficients are suppressed for brevity.

Table 3b: **Regression results, envisaged current and fiscal account ratios: Horizon T+1.**

| | $\Delta\ \hat{y}_{jT+1}$ | | $\Delta\hat{c}_{jT+1}$ | | $\Delta\ \hat{y}_{jT+1}$ | | $\Delta\hat{c}_{jT+1}$ | |
|---|---|---|---|---|---|---|---|---|
| | Coefficient | S.E. | Coefficient | S.E. | Coefficient | S.E. | Coefficient | S.E. |
| | | | | | | | | |
| $\Delta\hat{c}_{jT+1}$ | 0.158 * | (0.08) | | | 0.179 ** | (0.08) | | |
| $\Delta\hat{y}_{jT-1}$ | -0.175 * | (0.10) | 0.020 | (0.16) | -0.165 * | (0.09) | 0.104 | (0.16) |
| $\Delta\hat{c}_{jT-1}$ | 0.049 | (0.08) | -0.208 * | (0.12) | 0.034 | (0.07) | -0.364 *** | (0.12) |
| | | | | | | | | |
| $\hat{y}_{jT-1}$ | -0.462 *** | (0.11) | -0.029 | (0.18) | | | | |
| $\hat{c}_{jT-1}$ | 0.048 | (0.09) | -0.370 *** | (0.14) | | | | |
| | | | | | | | | |
| $em_{jT-1}$ | | | | | -0.474 *** | (0.11) | -0.128 | (0.19) |
| | | | | | | | | |
| N | 129 | | 129 | | 129 | | 129 | |
| $R^2$ | 0.86 | | 0.72 | | 0.86 | | 0.68 | |
| | | | | | | | | |

Variable definitions (this table only):

$$\Delta\hat{g}_{jT+1} = \hat{g}_{jT+1} - \hat{g}_{jT-1}$$
$$\Delta\hat{g}_{jT-1} = \hat{g}_{jT-1} - \hat{g}_{jT-3}$$

Full sample, Horizon T. Standard errors (S.E.) in parentheses.
*** indicates significance at the 99 percent confidence level, ** indicates significance at the 95 percent confidence level, and * indicates significance at the 90 percent level of confidence.
A complete set of time and country dummies were included in the regressions, but their coefficients are suppressed for brevity.

Table 4: **Estimation of the Projection Error Equations**

| $\Delta\hat{c}_{jT} - \Delta c_{jT}$ | | | $\Delta\hat{y}_{jT} - \Delta y_T$ | | |
|---|---|---|---|---|---|
| | OLS | 2SLS | | OLS | 2SLS |
| $c_{jT-1}$ | 0.01 | 0.04 | $c_{jT-1}$ | -0.11 ** | -0.10 ** |
| $\hat{c}_{jT-1} - c_{jT-1}$ | -0.41 ** | -0.31 ** | $\hat{c}_{jT-1} - c_{jT-1}$ | -0.06 | -0.07 |
| $y_{jT-1}$ | -0.10 | -0.02 | $y_{jT-1}$ | 0.01 | 0.04 |
| $\hat{y}_{jT-1}-y_{jT-1}$ | -0.19 | -0.25 * | $\hat{y}_{jT-1}-y_{jT-1}$ | -0.34 ** | -0.30 ** |
| $\Delta e_{jT}$ | -0.0003 | -0.002 | $\Delta e_{jT}$ | 0.01 ** | 0.01 |
| $\Delta\hat{e}_{jT}-\Delta e_{jT}$ | -0.005 | -0.001 | $\Delta\hat{e}_{jT}-\Delta e_{jT}$ | 0.007 | 0.009 |
| | | | $\Delta w_{jT}$ | 0.10 ** | 0.02 |
| | | | $\Delta\hat{w}_{jT}-\Delta w_{jT}$ | -0.47 ** | -0.47 ** |
| | | | $\Delta c_{jT-1}$ | 0.03 | 0.03 |
| | | | $\Delta y_{jT-1}$ | -0.08 * | -0.08 |
| N | 172 | 162 | | 167 | 162 |
| $R^2$ | 0.59 | 0.59 | | 0.74 | 0.71 |

The 2SLS procedure used the estimating equations below for $\Delta e_T$, $\Delta\hat{e}_T-\Delta e_T$, $\Delta w_T$ and $\Delta\hat{w}_T-\Delta w_T$, and estimated those equations simultaneously with the two reported above. The equations in the following table are all OLS, since they did not include endogenous regressors. The coefficients differ because of the number of observations included: those with 165 were estimated in the simultaneous-equation system, while those with other numbers of observations were estimated as single equations.

| $\Delta\hat{e}_{jT}-\Delta e_{jT}$ | | | $\Delta\hat{w}_{jT}-\Delta w_{jT}$ | | |
|---|---|---|---|---|---|
| | OLS | OLS | | OLS | OLS |
| $\Delta\hat{e}_{jT-1}-\Delta e_{jT-1}$ | 0.14 ** | -0.03 | $\hat{w}_{jT-1}-w_{jT-1}$ | -0.02 | -0.03 |
| $\Delta e_{jT-1}$ | -0.03 ** | -0.05 ** | $w_{jT-1}$ | 0.15 ** | 0.14 ** |
| | | | $\Delta w_{jT-1}$ | -0.06 | -0.06 |
| | | | $\Delta\hat{w}_{jT-1}-\Delta w_{jT-1}$ | -0.28 ** | -0.23 ** |
| | | | | | |
| N | 166 | 162 | | 166 | 162 |
| $R^2$ | 0.68 | 0.68 | | 0.52 | 0.53 |
| | | | | | |
| $\Delta e_{jT}$ | | | $\Delta w_{jT}$ | | |
| | OLS | OLS | | OLS | OLS |
| $\Delta e_{jT-1}$ | 0.01 ** | 0.03 ** | $w_{jT-1}$ | -0.39 ** | -0.38** |
| $c_{jT-1}$ | -0.10 | 0.04 | $\Delta w_{jT-1}$ | -0.13 ** | -0.16 ** |
| $y_{jT-1}$ | 0.37 | 0.28 | $y_{jT-1}$ | 0.27 ** | 0.29 ** |
| | | | | | |
| | | | | | |
| N | 174 | 162 | | 173 | 162 |
| $R^2$ | 0.65 | 0.74 | | 0.61 | 0.60 |

** indicates significance at the 95 percent level of confidence, while * indicates significance at the 90 percent level of confidence. Standard errors and other regression statistics are available from the authors on demand.

Table 5: **Test of Accuracy**

| Projection Model | Number of Observations | Fiscal Balance Ratios | Current Account Ratios |
|---|---|---|---|
| | | Theil's U statistic | |
| Projecting Level of the Macroeconomic Variable for the Year-T | | | |
| MONA projection | 176 | 0.643 | 0.568 |
| Random-Walk Benchmark | 176 | 0.781 | 0.594 |
| Projecting Level of the Macroeconomic Variable for the Year-T+1 | | | |
| MONA projection | 147 | 0.751 | 0.752 |
| Random-Walk Benchmark | 147 | 0.878 | 0.729 |

## Annex A: **Creating the error-correction residuals.**

In the following, we use the WEO data set covering those programs with time horizon T. There are 175 observations in general, although somewhat more when considered in levels.

Creating the error-correction residual $e_{jt}$

Dependent Variable: $y_{jt}$ (WEO)

Analysis of Variance

| Source | DF | Sum of Squares | Mean Square | F Value | Pr > F |
|---|---|---|---|---|---|
| Model | 86 | 5518.14566 | 64.16448 | 6.58 | <.0001 |
| Error | 96 | 935.61705 | 9.74601 | | |
| Uncorrected Total | 182 | 6453.76271 | | | |

| | | | |
|---|---|---|---|
| Root MSE | 3.12186 | R-Square | 0.8550 |
| Dependent Mean | -4.33059 | Adj R-Sq | 0.7252 |
| Coeff Var | -72.08859 | | |

Parameter Estimates

| Variable | DF | Parameter Estimate | Standard Error | t Value | Pr > \|t\| |
|---|---|---|---|---|---|
| $C_{jt}$ | 1 | 0.09996 | 0.06203 | 1.61 | 0.1103 |
| t93 | 1 | -7.41751 | 1.72365 | -4.30 | <.0001 |
| t94 | 1 | -4.83851 | 1.91288 | -2.53 | 0.0131 |
| t95 | 1 | -6.31586 | 1.84898 | -3.42 | 0.0009 |
| t96 | 1 | -5.37486 | 1.92894 | -2.79 | 0.0064 |
| t97 | 1 | -3.98082 | 1.88383 | -2.11 | 0.0372 |
| t98 | 1 | -3.63622 | 1.95216 | -1.86 | 0.0656 |
| t99 | 1 | -4.64533 | 1.95383 | -2.38 | 0.0194 |
| t00 | 1 | -5.26644 | 1.97374 | -2.67 | 0.0090 |
| t01 | 1 | -5.92937 | 1.83106 | -3.24 | 0.0017 |

This is the formulation used to create the error-correction variable ($e_{T-1} = y_t$ - predicted value) for WEO data. A complete set of country dummies was used as well, but is suppressed here.

The following regression results report the coefficients used in creating the error-correction variable for envisaged data.

Dependent variable: $y_{jt}$ (envisaged)

Analysis of Variance

| Source | DF | Sum of Squares | Mean Square | F Value | Pr > F |
|---|---|---|---|---|---|
| Model | 95 | 6449.94187 | 67.89412 | 5.29 | <.0001 |
| Error | 97 | 1244.26623 | 12.82749 | | |
| Uncorrected Total | 192 | 7694.20810 | | | |

| | | | |
|---|---|---|---|
| Root MSE | 3.58155 | R-Square | 0.8383 |
| Dependent Mean | -4.47401 | Adj R-Sq | 0.6799 |
| Coeff Var | -80.05230 | | |

Parameter Estimates

| Variable | DF | Parameter Estimate | Standard Error | t Value | Pr > \|t\| |
|---|---|---|---|---|---|
| $C_{jt}$ | 1 | 0.31664 | 0.07861 | 4.03 | 0.0001 |
| t93 | 1 | -6.84332 | 1.81926 | -3.76 | 0.0003 |
| t94 | 1 | -4.68806 | 1.95701 | -2.40 | 0.0185 |
| t95 | 1 | -5.69861 | 1.90593 | -2.99 | 0.0035 |
| t96 | 1 | -3.85602 | 1.93132 | -2.00 | 0.0487 |
| t97 | 1 | -3.34252 | 1.93759 | -1.73 | 0.0877 |
| t98 | 1 | -2.74118 | 1.85499 | -1.48 | 0.1427 |
| t99 | 1 | -4.38718 | 2.07410 | -2.12 | 0.0370 |
| t00 | 1 | -3.95966 | 2.08914 | -1.90 | 0.0610 |
| t01 | 1 | -5.05367 | 2.00406 | -2.52 | 0.0133 |

A complete set of country dummies was used as well, but is suppressed here.

## Annex B. **Does the timing of approval of IMF-Supported Programs Matter to these results?**

One possible explanation for the projection errors analyzed in the text is the uneven timing of approvals of IMF-supported programs. In the text we treat each program as having been approved at the beginning of "Year T", so that the projected effects of the program on macroeconomic adjustment have a full year to take hold. In fact, programs are approved at different times within Year T.

Projection errors may reasonably be hypothesized to follow from earlier approval in Year T. We investigated this hypothesis in two ways. First, we calculated Pearson correlations of the approval month with the size of the projection error for horizons T and T+1. Second, we regressed the projection error on dummy variables indicating the quarter of Year T in which approval occurred.

The Pearson correlations in Table B1 provide no evidence of a significant approval-time effect in either variable. In Table B2, for the fiscal ratio there is no evidence of a significant approval-time effect. For the current-account ratio, a number of coefficients are positive and significant. However, they do not grow uniformly over the sample; the largest deviations from the mean occur for programs approved in the second and third quarters of "year T".

We did the same exercise for the deviation in initial conditions; in that case, the hypothesis is that programs approved later in Year T will have more accurate information on the initial conditions, so that deviations will be lessened. In Table B3, there is no evidence of a significant effect in the Pearson correlations. There is some evidence of this in the regression results of Table B4, however. For both variables, the deviation in initial conditions is significantly smaller on average for programs approved in the first quarter of year T than for those approved later in year T. There is thus a downward bias in the fiscal ratios used as initial conditions in projections created in the first quarter of year T relative to the historical data, most likely because the IMF staff did not have access to the later revisions when creating its projections.

Table B1: Pearson correlations for projection errors.

| | Fiscal balance: Original program. Approval Month in T | Current account: Original program. Approval month in T |
|---|---|---|
| Horizon T | 0.01905 | 0.00687 |
| | 0.8364 | 0.9406 |
| | 120 | 120 |
| Horizon T+1 | -0.05439 | 0.14289 |
| | 0.5853 | 0.1499 |
| | 103 | 103 |

Table B2: Regressions on quarterly dummies (horizon T) for projection errors.

| | Fiscal balance (OP) | Current Account (OP) |
|---|---|---|
| Quarter 1 | 0.06 | 0.44 |
| | (0.46) | (0.69) |
| Quarter 2 | -0.27 | 1.08* |
| | (0.39) | (0.60) |
| Quarter 3 | 0.26 | 1.76** |
| | (0.51) | (0.77) |
| Quarter 4 | 0.44 | 0.13 |
| | (0.59) | (0.90) |
| $R^2$ | 0.01 | 0.07 |
| N | 120 | 120 |

Table B3: Pearson correlations for discrepancies in initial conditions (actual - projection).

| | Fiscal balance: Original program. Approval Month in T | Current account: Original program. Approval month in T |
|---|---|---|
| All horizons | 0.13744 | 0.09385 |
| | 0.1328 | 0.3076 |
| | 121 | 120 |

Table B4: Regressions on quarterly dummies for discrepancies in initial conditions (FR-OP).

| | Fiscal balance (OP) | Current Account (OP) |
|---|---|---|
| Quarter 1 | -0.80** | -1.75** |
| | (0.39) | (0.73) |
| Quarter 2 | -0.37 | -0.95 |
| | (0.34) | (0.63) |
| Quarter 3 | 0.27 | -0.75 |
| | (0.44) | (0.82) |
| Quarter 4 | -0.18 | -0.34 |
| | (0.51) | (0.95) |
| $R^2$ | 0.05 | 0.07 |
| N | 120 | 120 |

*** indicates significance at the 99 percent confidence level, ** indicates significance at the 95 percent confidence level, and * indicates significance at the 90 percent level of confidence.