BP/04/2

IEO Background Paper

Macroeconomic Adjustment in IMF-Supported Programs: Projections and Reality

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INDEPENDENT EVALUATION OFFICE

INTERNATIONAL MONETARY FUND

 BP/04/2

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Macroeconomic Adjustment in IMF-Supported Programs: Projections and Reality[1]

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April 2004

Abstract

This paper examines the accuracy of IMF projections in 175 programs approved in the period 1993-2001, focusing specifically on ratios of the fiscal surplus to GDP and external current account surplus to GDP. Four potential reasons for divergence of projected from actual values are identified: (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 analysis suggests that while all are important, incomplete information on initial conditions is the largest contributor to projection inaccuracy. We also investigate the role of revisions over time in projection error, and find that they improve projections for fiscal account data, while the current account continues to indicate a great deal of variability in the revision process.

JEL Classification Numbers: E62, C31

Keywords: Macroeconomic adjustment, initial conditions, fiscal surplus, external current account surplus, data analysis, projections, actuals.

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[1] A version of this paper was presented at Yale University Conference on the *Role of the World Bank and the IMF in the Global Economy*, 25–27 April 2003. An abbreviated version will be published in a volume of conference proceedings.

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I. INTRODUCTION

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.[3] 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 a complete decomposition of these effects. We also investigate the degree to which revisions to the projection eliminate these deviations due to incomplete information. We find that revisions tend to approximate more closely the historical data, but that substantial differences remain between the revised projections and the historical data.

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.[4] The data on historical outcomes are drawn from the "World Economic Outlook" (WEO) database of the IMF as reported in June 2002. Given the

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[3] 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.

[4] 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. We will use the "first review" projections for each program in a later section.

difference in sources, some data manipulation is necessary to ensure comparability.[5] The data are redefined in each case to be relative to the initial program year: it is denoted the "year T" of the program.[6] We will examine four projection "horizons" in this study. 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 observations available for comparisons is as follows for horizons T through T+3: 175, 147, 115 and 79.

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 multiple 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 previous program in that country.

[5] 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.

[6] 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.

II. 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.[7] 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 Δy_{jk} and Δc_{jk}, we find that projections differ substantially from those actually observed. Figure 1a illustrates the pattern of mean changes in projected and historical fiscal ratios.[8] 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 1a: Mean Historical and Projected Changes in Fiscal Ratios

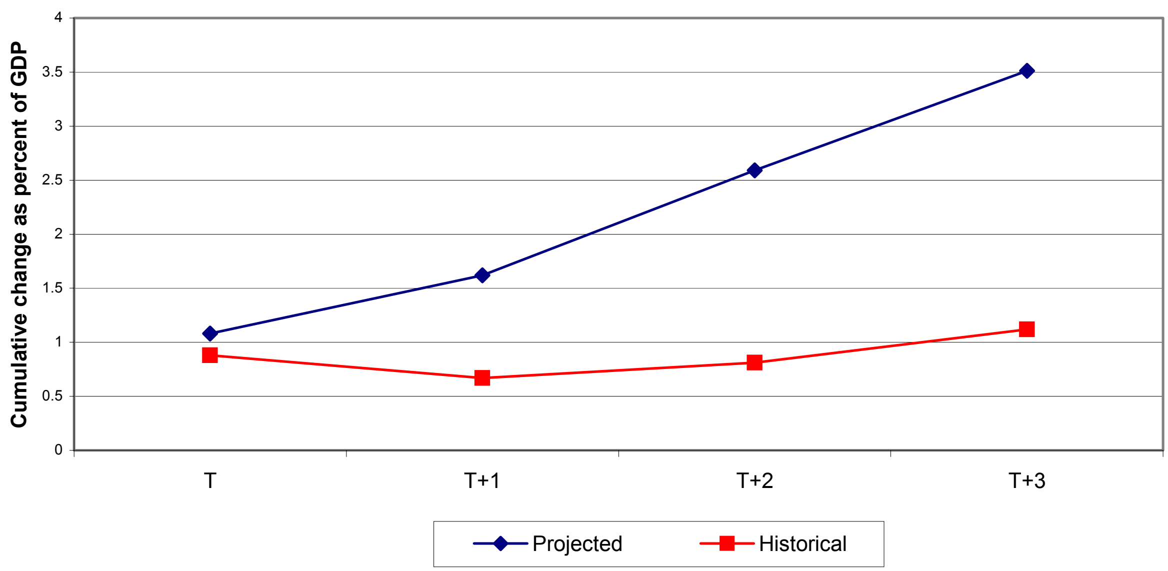

Figure 1b illustrates the pattern for changes in projected and actual current-account ratios. The mean projected change in the current-account ratio is negative for horizon T and horizon T+1. The change becomes positive and growing for longer projection horizons. The historical change in current-account ratio for participating countries followed a different dynamic:

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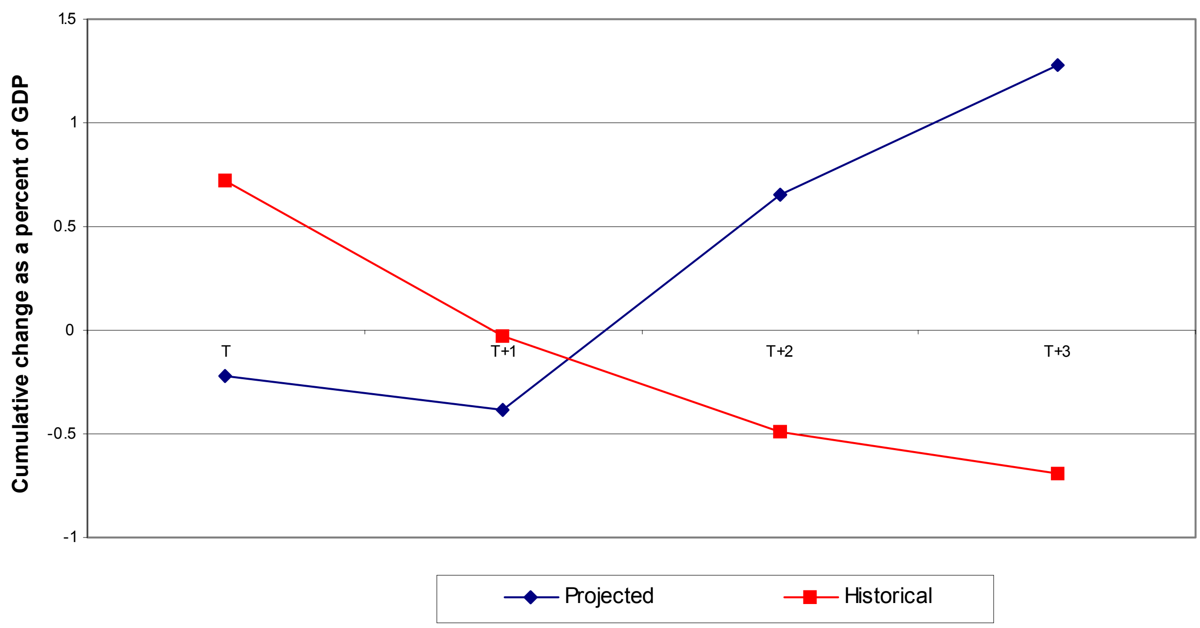
[7] In this section, we use the projections from the "original program."

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

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.

While these mean differences are suggestive, they cover up the great variability in projections and realizations for both ratios. Figures 2a through 2h illustrate the historical and envisaged changes in each variable for each projection horizon. The diagonal line indicates values at which projected change is just equal to historical change. The dispersion in values around the diagonal lines is quite striking.[9] For both fiscal and current-account ratios there is evidence of projected exceeding historical changes. This is especially striking for the fiscal ratios over time, as the proportion of observations to the right of the diagonal line rises with projection horizon. There is also evidence of historical values more extreme than projected, especially for the changes in current-account ratio.

Figure 1b: Mean Historical and Projected Changes in Current-Account Ratio



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[9] Table 1 reports the standard deviations of the projected and actual changes in the database; these are in all cases and for all projection horizons at least as large as the mean values.

The correlations between projected and historical changes of the two ratios over the various time horizons are:

Horizons	T	T+1	T+2	T+3
Fiscal ratio (Δy_{jk}, $\Delta \hat{y}_{jk}$)	0.61	0.56	0.31	0.56
Current account ratio (Δc_{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?

Figure 2a: Fiscal ratios for horizon T

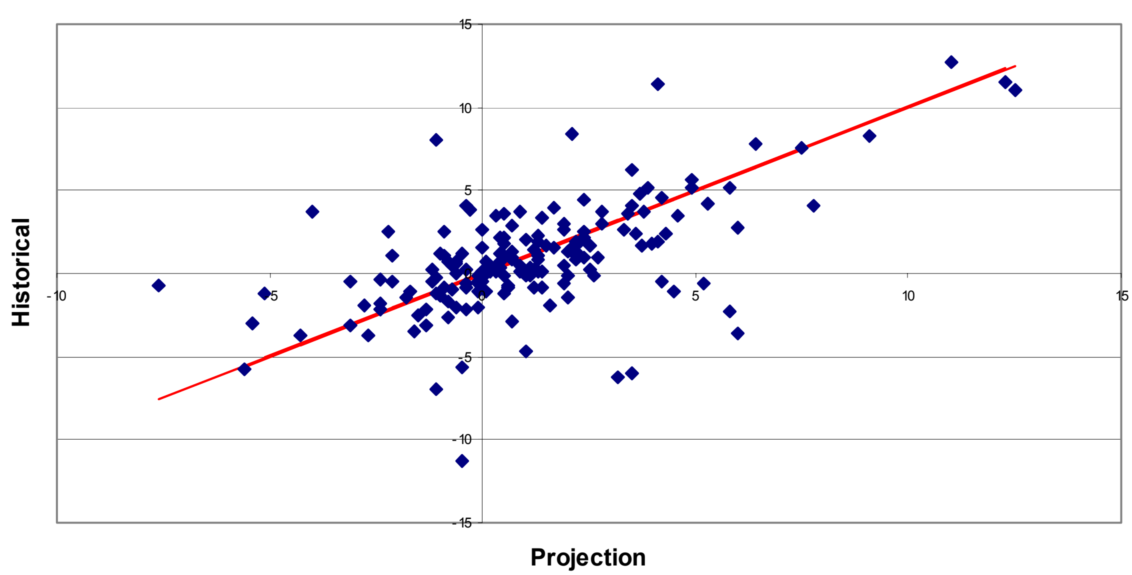


Figure 2b: Current-account ratios in horizon T

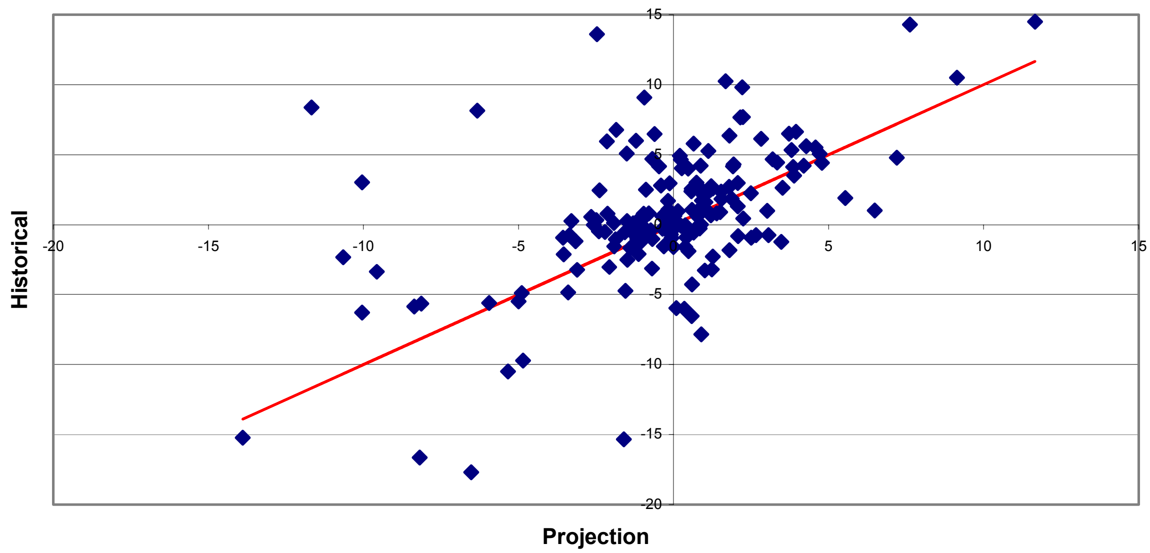


Figure 2c: Fiscal Ratios in horizon T+1

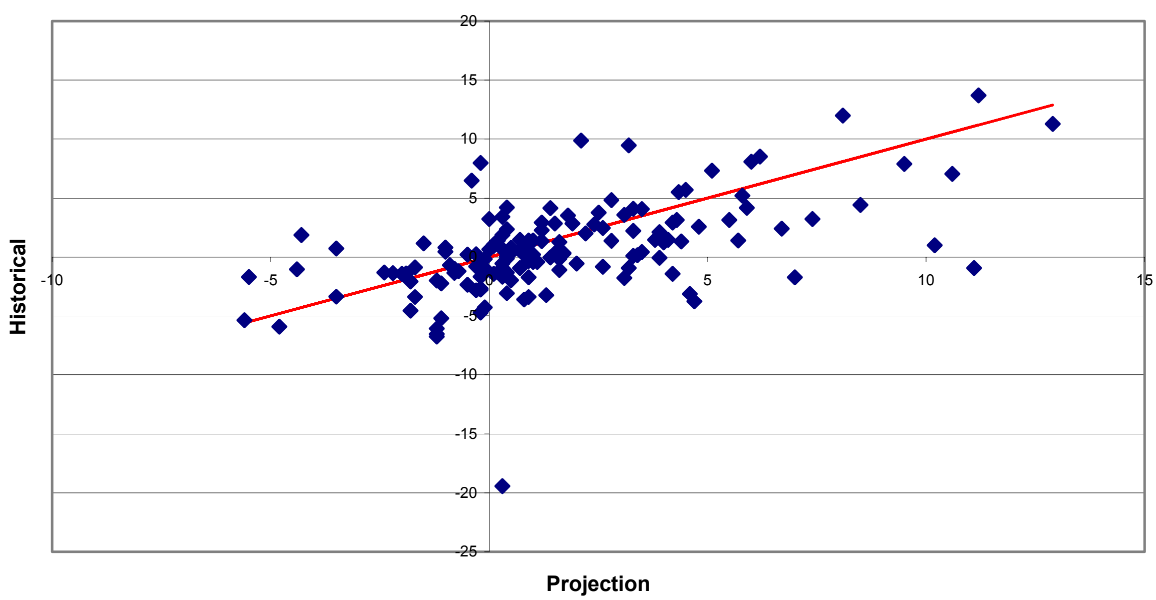


Figure 2d: Current Account Ratios in horizon T+1

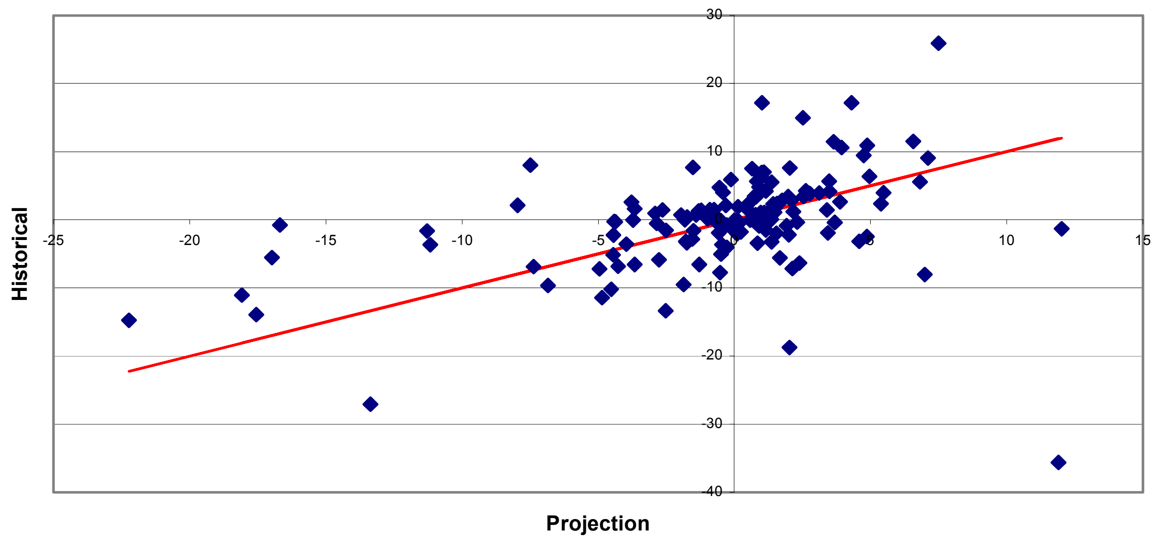


Figure 2e: Fiscal Ratios in horizon T+2

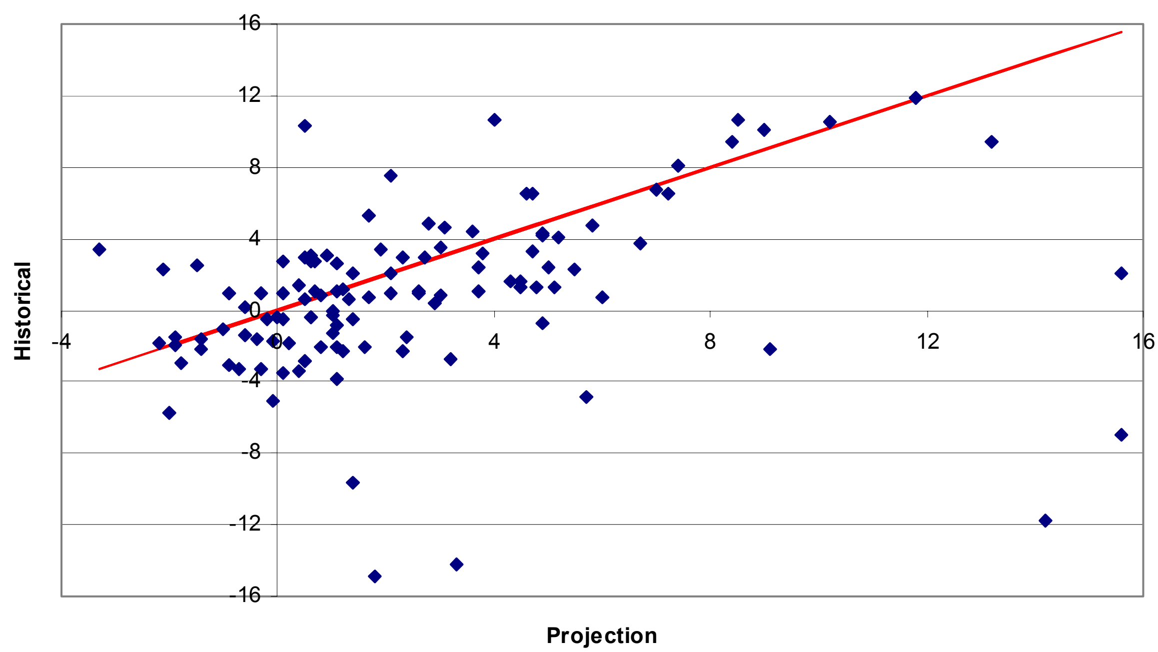


Figure 2e: Fiscal Ratios in horizon T+2

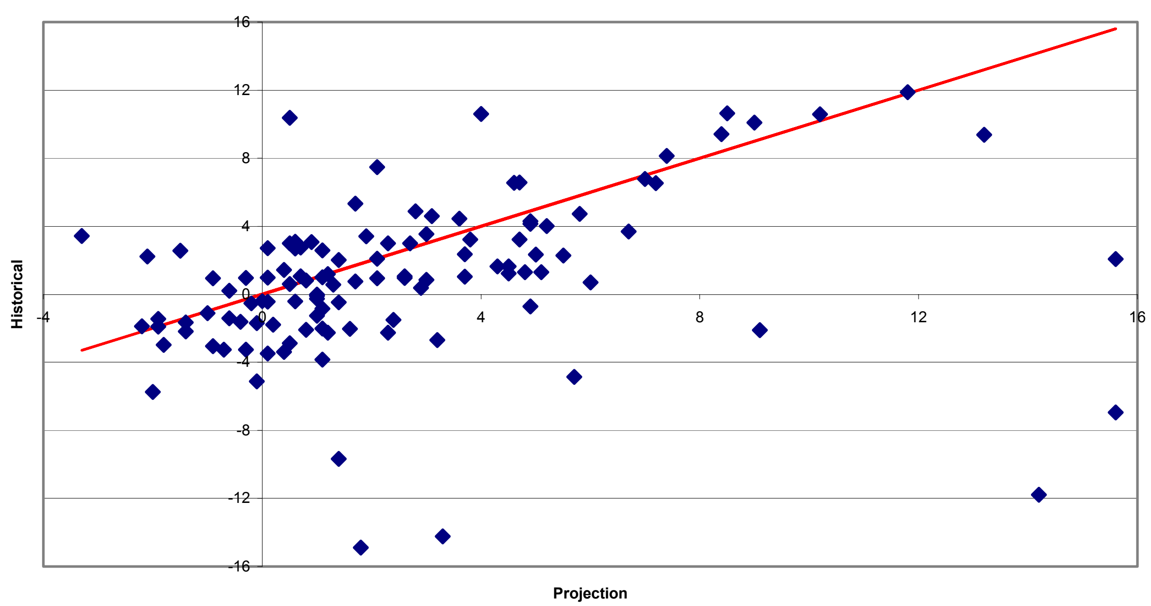


Figure 2g: Fiscal Ratios in Horizon T+3

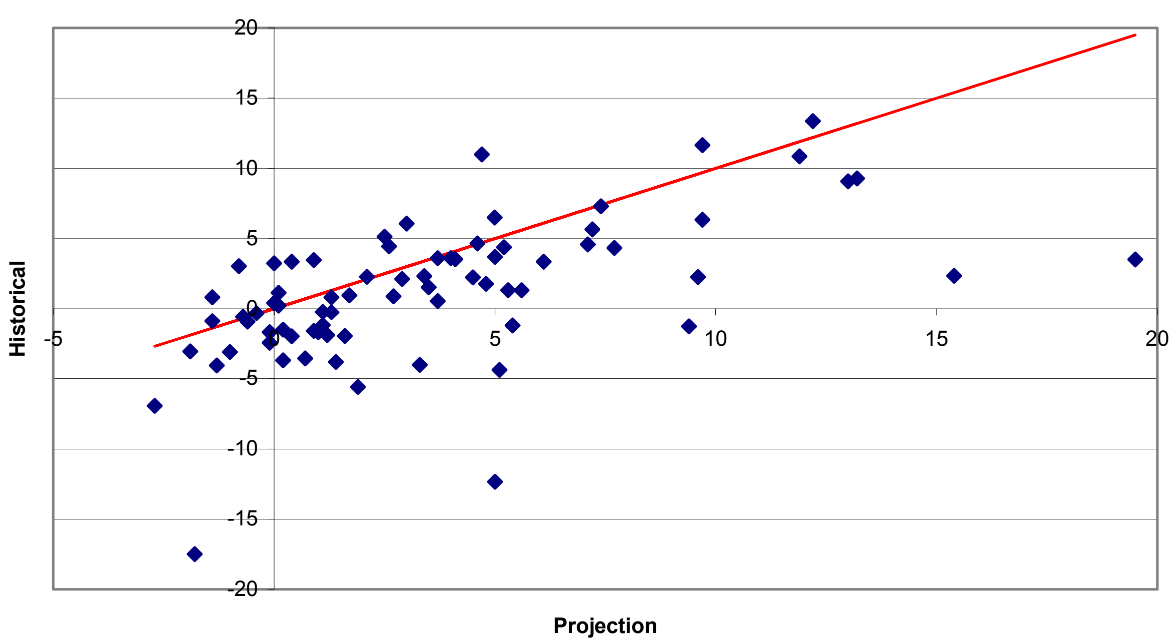
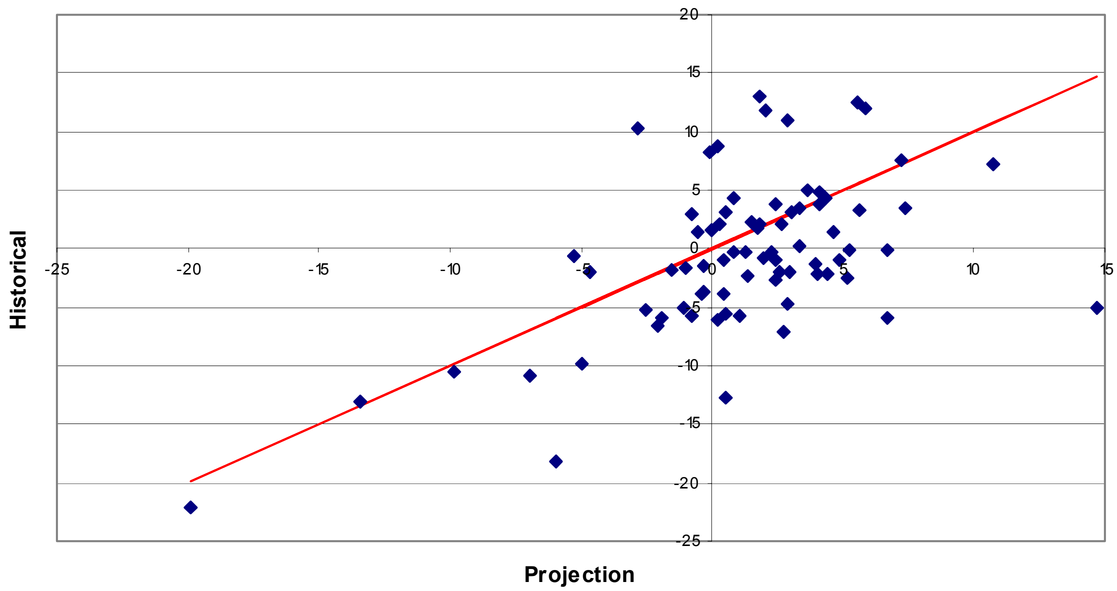


Figure 2h: Current Account ratios in horizon T+3



III. 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 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.[10] 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 $(\Delta \hat{g}_T - \Delta g_T)$.[11]

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[10] By contrast, we consider the forecast 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.

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

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 (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}.[12] 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 (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.

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

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

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-

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[11] 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.

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

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:

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

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 ejt = (pjt - pnjt) 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.[13]

[13] 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

(continued…)

$$\Delta y_{jt} = a_o - a_{12}\,\Delta y_{jt-1} - b_{12}\,\Delta c_{jt-1} + (a_{11}+a_{12}-1)\,y_{jt-1} + (b_{11} + b_{12})c_{jt-1} + \varepsilon_{yjt} \quad (7a)$$

$$\Delta c_{jt} = b_o - a_{22}\,\Delta y_{jt-1} - b_{22}\,\Delta c_{jt-1} + (a_{21}+a_{22})\,y_{jt-1} + (b_{12}+b_{22}-1)c_{jt-1} + \varepsilon_{zjt} \quad (7b)$$

There is in general no way to assign contemporaneous causality in (7a) and (7b). 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 Δy_{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 Δc_{jt-1} and Δy_{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 (7) 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 Δs_{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 the coefficient estimates from equations (7) for all programs in the sample at horizon T using historical data are summarized in Table 2a (Annex I). Specification testing revealed that lagged first-difference terms with lag length greater than two did not contribute

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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 (7) in place of the terms in y_{jt-1} and c_{jt-1} and will have the coefficient associated with y_{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 Δy_{jt} equation. Hamilton (1994, chapter 19) provides a clear derivation of this error-correction form from the underlying autoregression.

significantly to the regression.[14] 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.[15] The error-correction term (e_{jT-1}) was derived from the regression in levels (i.e., not first-differenced) reported in Annex II.

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

- 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 0.28 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 Δy_{jT-1}, there is other things equal a 0.25 increase in Δy_{jT}. For a unit shock to Δy_{jT-2}, the transmitted shock is positive and significant at 0.16. Past positive current-account shocks have small negative effects on Δy_{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.

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.

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[14] 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.

[15] 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 last four columns of Table 2a (Annex I) 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 Δy_{jT} regression. The cointegrating relationship is less effective in the Δc_{jT} equation, however, as indicated by the R^2 statistic.[16]

These results are specific to the data for horizon T. Results for horizon T+1 are presented in Table 2b (Annex I). 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 (Annex I) for projection horizon T.

The results from estimating the projection model for the fiscal ratio suggests the following (see 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.

[16] 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.[17] 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 (Annex I):

- There is no significant evidence of an autoregressive structure in Δc_{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 ⅓ 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 (Table 3b, Annex I), the projection "model" 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

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[17] 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.

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 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.[18] 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 ($\Delta\hat{e}_{jT}$ -Δe_{jT}) and the difference between projected and historical change in government consumption expenditures as a share of GDP ($\Delta\hat{w}_{jT}$ -Δw_{jT}).[19] 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, ($\Delta\hat{e}_{jT}$ -Δe_{jT}), ($\Delta\hat{w}_{jT}$ -Δw_{jT}), Δe_{jT} and Δw_{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

[18] For now we treat each program as if it was approved 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. Thus, the timing of approval within the year may explain part of the projection error. We explore this in Annex III.

[19] 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.

simultaneity bias.[20] 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 (Annex I). 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 coefficients reported in Tables 2 and 3. 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}, Δc_{jT-1}, $\Delta y_{jT-1,}$ Δe_{jT} and Δw_{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), Δe_{jT-1} (0.01), Δy_{jT-1} (-0.08) and Δw_{jT} (0.10). If we consider the last case for illustration: a positive Δw_{jT} should reduce the fiscal balance. The coefficient (0.10) indicates that the IMF projections incorporated less pass-through 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.

[20] 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.

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 staff 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 IMF staff had access to artificially high estimates of the previous-period fiscal ratio, they adjusted downward the projected policy adjustment necessary. This 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 ($\Delta\hat{w}_{jT}$ -Δw_{jT}) and ($\Delta\hat{e}_{jT}$ -Δe_{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 ($\Delta\hat{w}_{jT}$ - Δw_{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 ($\Delta\hat{w}_{jT}$ -Δw_{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 ($\Delta\hat{e}_{jT}$ -Δe_{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.

An empirical decomposition of projection error

In previous sections we identified several potential sources of projection errors. The magnitude and significance of the regression coefficients reported in Table 4 shed some light on the relative importance of each of the sources. To investigate this issue in more details and to get a better insight about relative contribution of each of the sources to the resulting projection errors, we implement the following exercise. Setting variables used in the 2SLS regressions of Table 4 to their mean values and using estimated coefficients, we compute contribution of each of the model variables to the projection errors for current account and fiscal balance ratios, ($\Delta\hat{c}_{jT}$ - Δc_{jT}) and ($\Delta\hat{y}_{jT}$ - Δy_T) respectively. Using means of projection errors as anchors, we can draw some conclusions about relative contribution of differences in modeling, differences in initial conditions, and differences in policy response to the projection errors. Tables 5a and 5b (Annex I) summarize results of the described experiment for current account and fiscal balance projection errors respectively.

In the case of current-account ratios, the most significant source of projection error comes from the measurement of the initial conditions. This component is responsible for 44.55 percent of the total projection error while differences in modeling and differences in policy response generate forecast errors with the magnitudes of only 16.63 and 0.85 percent respectively. The positive signs of percentage contributions of all three sources suggest that these sources of errors tend to bias current account mean projection error toward negative values.

However, when the components of the forecasting error for fiscal-balance ratios are considered, the two major sources of the errors are differences in modeling (166.17 percent) and mismeasurement of initial conditions (-52.78 percent). It appears that the model used in projections tends to make projection error more positive while measurement error in the initial conditions pulls projection error in the negative direction, as it was in the case of the current account projection errors. Differences in policy response are responsible for approximately 16 percent of the total mean projection error.

Projection errors of both variables are greatly influenced by the year and country specific factors captured by the corresponding dummy variables.

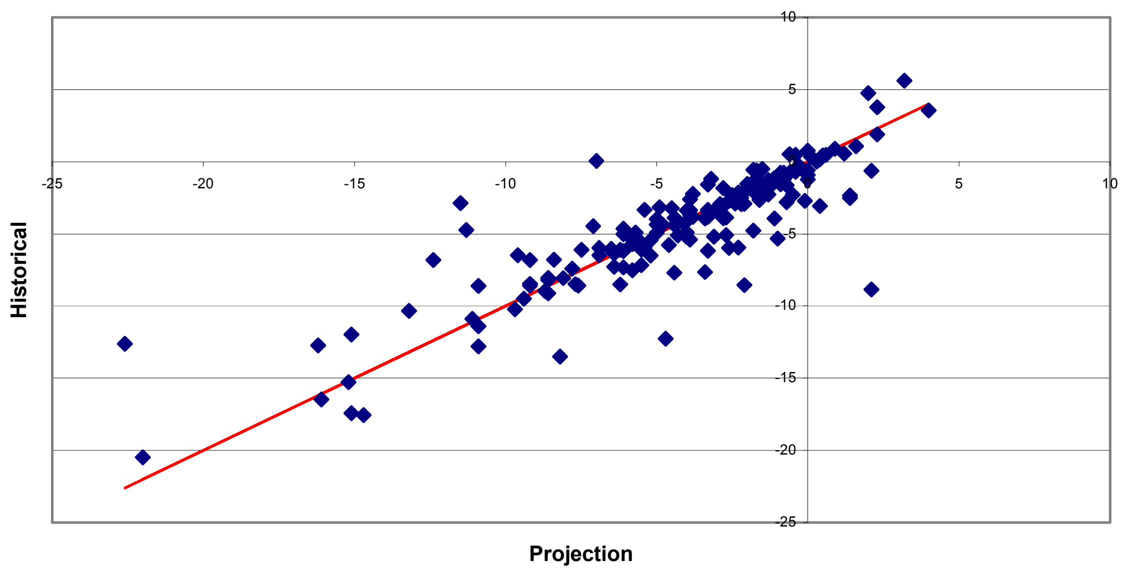
It is evident in examining the data that there is substantial mismeasurement in the fiscal and current account ratios when the initial values in the two databases are compared. Simple statistics for the actual and projection ratios are as follows (based on 175 observations):

	Mean	Standard Deviation	Minimum	Maximum
c_{jT-1}	-6.24	7.89	-39.82	11.08
$\hat{c}_{jT-1}$	-5.09	5.99	-39.92	10.41
y_{jT-1}	-4.36	4.11	-20.48	5.61
$\hat{y}_{jT-1}$	-4.22	4.42	-22.60	4.00

The difference in mean between historical and projected data for the current-account ratio is quite striking. $\hat{c}_{jT-1}$ should be known (i.e., historical) at the time of the projection. Differences of this magnitude are an indication that there has been substantial revision in the macroeconomic aggregates over time.[21] The difference in mean for the fiscal ratio is not so pronounced. The standard deviations are large, and these differ substantially between actual and projection databases. There is more variability in the actual current-account ratios than in those projected; by contrast, there is more variability in the projected fiscal ratios than there is in the actual ratios.

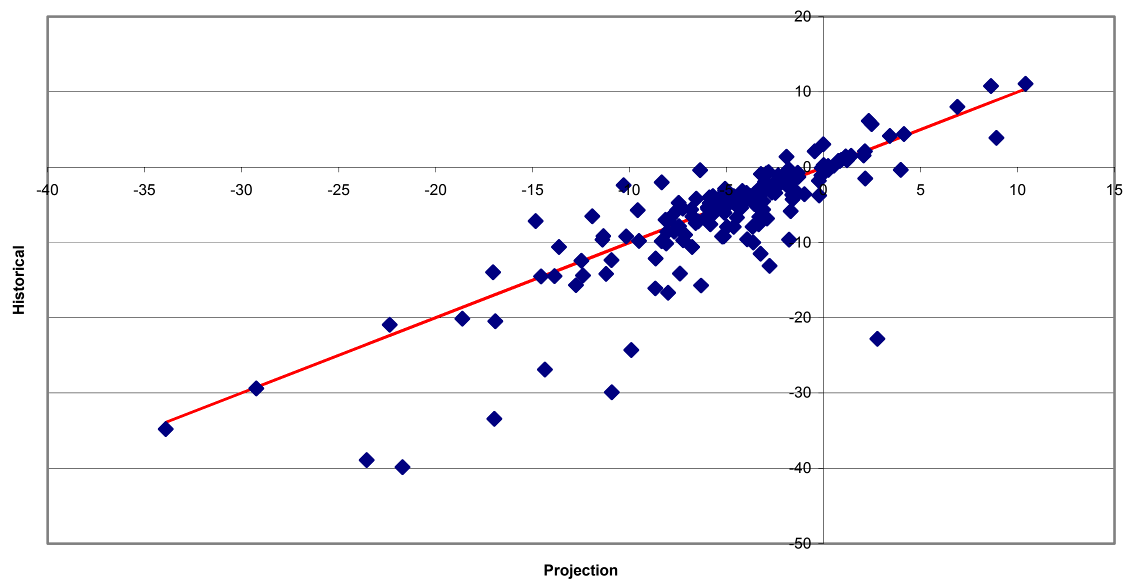
Figures 3 and 4 present the scatter plots of actual and projected ratios. The 45^{o} line represents those combinations for which projected coincides with actual. As is evident in these figures, there is tremendous measurement error even in these initial conditions. There is also a strong positive correlation of projection with actual: for (c_{T-1}, $\hat{c}_{T-1}$) it is 0.84, while for (y_{T-1}, $\hat{y}_{T-1}$) it is 0.86. There is not the perfect match that would exist in theory, but the match is quite strong.

Figure 3: Initial Conditions for fiscal account ratio



[21] We have been careful in constructing the dataset, but we must admit as well the possibility that the definition of current account used in the historical data may differ in some instances from the definition used in the envisaged data. While we see no reason for this difference to be systematic, it may well represent some of the observed difference in mean values.

Figure 4: Initial Conditions for current account ratio



IV. Examining the Role of Revisions

New information is made available to the IMF staff on a continuous basis throughout the duration of the IMF program. The staff periodically revisits its initial projections in the context of a program review, and updates them to reflect the information more recently received. We should then observe that the IMF projections converge to the actual performance as revisions are made over the duration of a multi-period IMF program: imprecision in initial conditions will be eliminated, projected policy reform can be revised in light of observed behavior, and inaccuracy in the forecasting model can be reduced. Moreover, one can expect that for multi-period programs, the major efforts of the IMF staff in the design of the original programs would be concentrated on improvement of short horizon projections while less emphasis is placed on long horizon projections since they can be fine-tuned in the context of later reviews.

Assuming that the new information is efficiently incorporated, we expect to observe that the IMF projections converge to the historical performance as revisions are considered. Therefore, any assessment of the quality of the IMF projections will be incomplete without examining the evolution of projections. We address this issue by comparing the projections of the original programs (OP) with those reported in the first reviews (FR) that take place during the first program year.[22] Some basic qualitative information on the evolution of the outcome projections can be illustrated by Figures 5a and 5b where we compare historical and envisaged mean changes in the fiscal- and current-account ratios. These plots are based on the data summarized in Table 6 (Annex I).[23] An obvious observation is that for the vast majority of projection horizons the first review projections, $\Delta \hat{y}_{jk}^{FR}$ and $\Delta \hat{c}_{jk}^{FR}$, are closer to the actual outcomes, Δy_{jk} and Δc_{jk}, than the original program projections, $\Delta \hat{y}_{jk}^{OP}$ and $\Delta \hat{c}_{jk}^{OP}$. The only exception is the change in the fiscal ratio for the horizon T.

Assessment of only mean changes might be misleading since, as we showed in the previous sections, there is a great deal of variability in envisaged and historical data. Some additional insights on the evolution of the projections can be obtained by examining developments in correlations between envisaged and actual changes. Table 7 (Annex I) reports those correlations for fiscal and current account ratios for both first reviews and original programs. As we found in the regressions of the previous section, envisaged changes in fiscal ratios exhibit higher correlation with the actual changes than do comparable changes in envisaged and actual current account ratios. This observation is true for projections drawn from the original program as well as those from the first reviews. Inaccuracy of the current account projections seems to worsen significantly with the length of the projection horizon. Also, there is a strong pattern showing that the projection performance of the first reviews, measured by the correlation coefficient, improves relative to the projections of the original programs for all variables and all projection horizons. The gain in forecasting power is particularly noticeable over short horizons and decreases as the length of the projection horizon extends.

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[22] Actual timing and number of reviews vary from program to program. In general, standby and extended arrangements (SBA and EFF) have more frequent reviews than structural adjustment facilities (SAF, ESAF and PRGF). Further, the completion of reviews is often held up by difficulties in complying with conditionality. For these reasons, we plan in future research to address the relationship between review timing and projection error.

[23] Figures 5a and 5b include similar information to that of Figures 1a and 1b. They differ, however, in the number of observations used in creating the mean values. For example, Figure 1a uses 175 observations for horizon T to calculate the mean historical and envisaged change in the fiscal ratio, while Figure 5a uses 120 observations for which both original program and first review observations of fiscal ratio are available.

Figure 5a: Means of Projected and Historical Changes in Fiscal Ratios

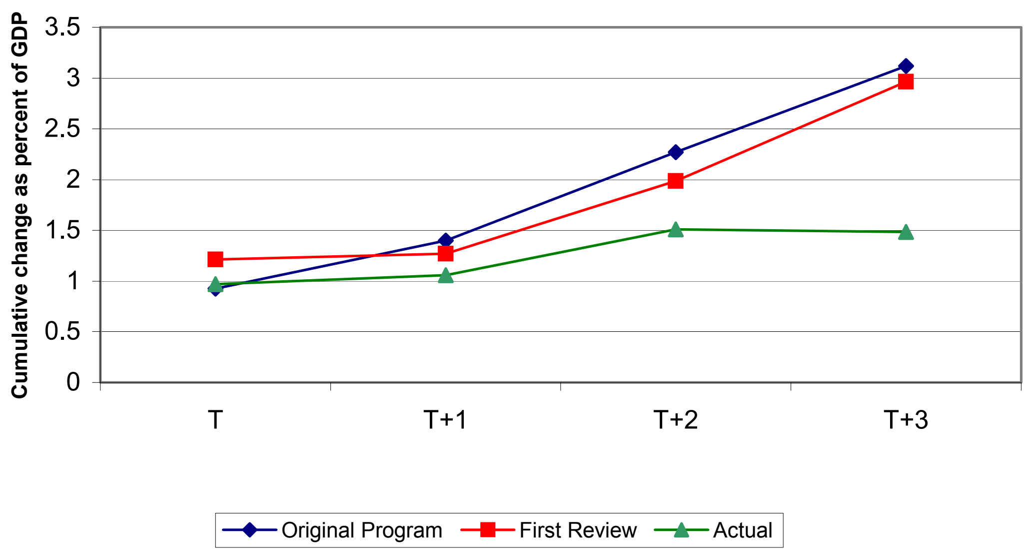
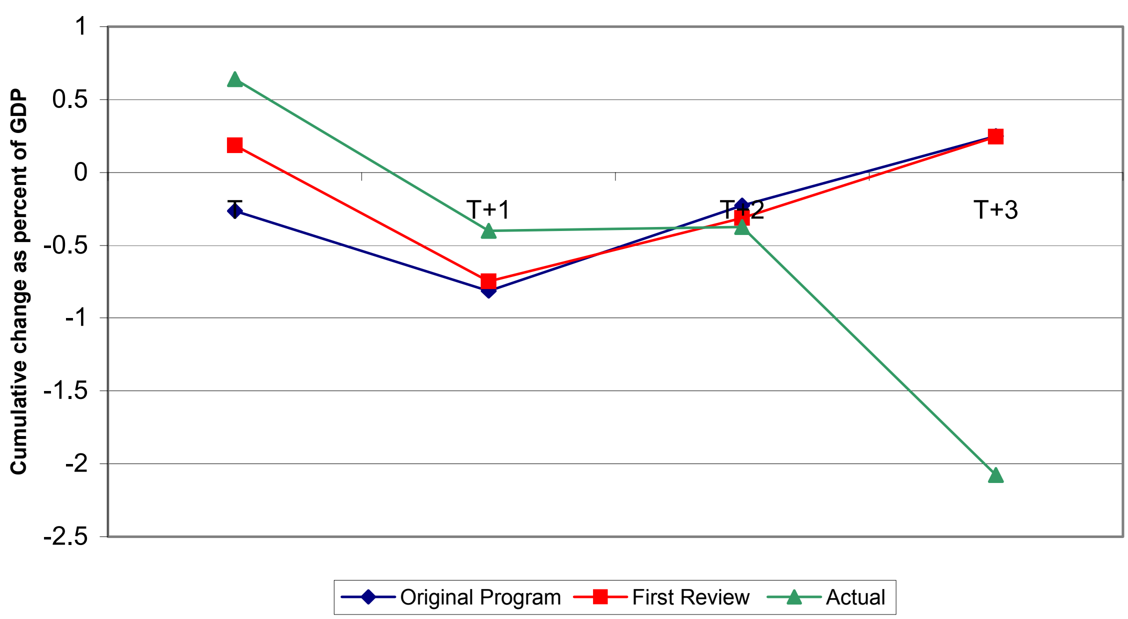


Figure 5b: Mean of Projected and Historical Changes in Current-Account Ratios



Bias, efficiency and accuracy of revisions

An interesting approach to evaluating projections was suggested by Musso and Phillips (2001). They analyze projections on the basis of three major characteristics: bias, efficiency, and accuracy. In this paper, we follow their approach and document some of the facts along these three dimensions in order to compare relative performance of the projections of the original programs and their first revisions.

Bias. By bias, we refer to the divergence of the distribution of projection errors from the zero-mean normal distribution. Table 8 (Annex I) presents statistics characterizing the distribution of ($\Delta\hat{c}_T$ - Δc_T) and ($\Delta\hat{y}_T$ - Δy_T) for the original programs as well as for their first revisions.[24] Several observations can be made from the information of Table 8:

- The null hypothesis of the true mean of the distribution being zero is rejected more frequently for the original program projection errors than for those from the first reviews. It is especially noticeable for the fiscal balance ratios.

- Standard deviations are considerably smaller for the first review projection errors than those for the original programs. The difference is greater for short horizons and becomes very small or even reverts for longer horizons.

- For the horizon T, positive skew of the distribution of the projection errors for both variables suggests that projection errors are more likely to be far above the mean than they are to be far below the mean. This result can be observed for both groups of projections. However, for longer horizons, skew tends to be negative reflecting the opposite trend.

- For both variables and for most of the horizon lengths, the distribution of errors has more mass in the tails than a Gaussian distribution with the same variance. The only exceptions are projection error distributions for horizon T changes in current account (FR), and horizon T+1 changes in fiscal balance (both OP and FR).

- For the OP projection errors, most of the tests find statistically significant evidence that the distributions exhibit lack of normality. The only exception is T+1 horizon for fiscal balances. For the FR projection errors, the results are mixed. Some of the goodness-of-fit tests for normal distribution cannot reject the null hypothesis of normality.[25]

[24] Projection errors are calculated as the differences between envisaged values and actual realizations.

[25] We used Kolmogorov-Smirnov, Cramer-von Mises, Anderson-Darling, and Chi-Square tests to check normality.

Efficiency. We test the efficiency of the FR and OP projections by regressing the value of the historical change on a constant term and the value of projected change as illustrated in (8a) and (8b) for macroeconomic variable g_T with v_T and u_T as random errors. We perform the estimation for changes in variables as well as for the levels.

$$\Delta g_T = c_o + c_1 \Delta \hat{g}_T + v_T \quad (8a)$$

$$g_T = d_o + d_1 \hat{g}_T + u_T \quad (8b)$$

This type of efficiency test is referred to as the weak criterion since it uses a limited information set (Musso and Phillips, 2001). We would conclude that the projection was an efficient estimate of the historical datum if the intercept were insignificantly different from zero and the slope were insignificantly different from unity. Tables 9 and 10 (Annex I) report results of the estimation in changes and in levels respectively.

There is a striking relationship between historical and projected changes found in the data: in each case for the original program (except horizon T+3 changes in current-account ratios) the hypothesis of weak efficiency is strongly rejected by the data. The rejection is in all cases based upon an estimate of c_1 or d_1 that is significantly less than unity. When the FR results are examined, weak efficiency is once again rejected. However, when compared to the OP results, the coefficient estimates of c_1 and d_1 are closer to the hypothesized value of unity.[26]

Accuracy. We test relative accuracy of the OP and FR projections by comparing them with a random-walk benchmark projection. That is, we investigate whether the IMF projections of the year-T values of the variables do better than if the projections were simply set equal to the T-1 value. We draw our conclusions from Theil's U statistic and report results in Table 11 (Annex I).[27] Larger values of the U statistic indicate a poor projection performance. The benchmark random walk projections for OP are based on the T-1 value of the variable as it is

[26] There is a difficulty in this type of estimation not addressed by Musso and Phillips (2001). Since the right-hand-side variable is only an estimate of the true OP projection, the regression may be characterized by error-in-variables. This will cause the slope coefficient to be biased downwards. We investigated this possibility using an instrumental-variable technique. The resulting slope coefficients were in most cases closer to unity and insignificantly different from unity for the fiscal ratio, thus exhibiting weak efficiency. They were farther from unity for the current-account ratio, thus sustaining the conclusion of inefficiency for that variable.

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

documented in OP, while the benchmark random-walk projection for FR uses the initial conditions from the revised data of FR.

For the fiscal balance, both OP and FR projections perform better than the random walk. However, only the FR projection outperforms the random walk for the current account; the OP projection for this variable is slightly worse than that of its random walk counterpart. Overall, the FR projections exhibit lower values of the U statistic reflecting their more accurate projections.[28]

An empirical decomposition

The preceding results suggest that the IMF staff modifies its projections to incorporate new information, and that the revised projections have better forecasting power when compared to the projections of the original programs. It is possible to decompose the difference in the OP and FR projections using a methodology similar to that of equation (3e) and Table 4. The details of this analysis are reported in Annex IV. The salient findings for our purpose are that

- There is a substantial difference in initial conditions used in the two projections, and these differences contribute significantly to the improvement of FR over OP.
- There is also evidence that the model used in the FR projections differs significantly from that used in the OP projections.

There is evidently "learning by doing" in these projections at the modeling stage as well as at the stage of data collection.

V. CONCLUSIONS

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.

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.

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[28] The pattern of errors in OP and FR projections are similar to those observed by Howrey (1984) in his study of inventory investment. He found in that case that there was evidence of substantial revision to initial data in inventory investment over the period 1954–1980. He also found, however, that knowledge of the revision reduced only marginally the variance of projection error.

Second, the IMF staff did appear to have a different model in mind when making its projections. 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 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 (1983) 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.

Our results on revisions 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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Table 1: Projecting the Change in Macroeconomic Aggregates

Horizon T

Variable	N	Simple Statistics Mean	Std Dev	Sum	Minimum	Maximum
$\Delta \hat{y}_{jT}$	175	1.08651	2.88011	190.14000	-7.60000	12.50000
Δy_{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
Δc_{jT}	175	0.72340	4.77454	126.59449	-17.68986	14.49604

Correlations:		$\Delta \hat{y}_{jT}$	Δy_{jT}	$\Delta \hat{c}_{jT}$	Δc_{jT}
	$\Delta \hat{y}_{jT}$	1.00000			
	Δy_{jT}	**0.60489**	1.00000		
	$\Delta \hat{c}_{jT}$	0.24256	0.12334	1.00000	
	Δc_{jT}	0.19968	0.30303	**0.53486**	1.00000

Horizon T+1

Variable	N	Simple Statistics Mean	Std Dev	Sum	Minimum	Maximum
$\Delta \hat{y}_{jT+1}$	147	1.62408	3.22486	238.74000	-5.60000	12.90000
Δy_{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
Δc_{jT+1}	147	-0.3233	7.07135	4.75294	-35.61176	25.90529

Correlations:		$\Delta \hat{y}_{jT+1}$	Δy_{jT+1}	$\Delta \hat{c}_{jT+1}$	Δc_{jT+1}
	$\Delta \hat{y}_{jT+1}$	1.00000			
	Δy_{jT+1}	**0.56182**	1.00000		
	$\Delta \hat{c}_{jT+1}$	0.13572	-0.02165	1.00000	
	Δc_{jT+1}	0.12453	0.04358	**0.38254**	1.00000

Horizon T+2

Variable	N	Simple Statistics Mean	Std Dev	Sum	Minimum	Maximum
$\Delta \hat{y}_{jT+2}$	115	2.59478	3.67922	298.40000	-3.30000	15.60000
Δy_{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
Δc_{jT+2}	115	-0.49056	7.32857	-56.41476	-38.14743	21.78397

Correlations:		$\Delta \hat{y}_{jT+2}$	Δy_{jT+2}	$\Delta \hat{c}_{jT+2}$	Δc_{jT+2}
	$\Delta \hat{y}_{jT+2}$	1.00000			
	Δy_{jT+2}	**0.31046**	1.00000		
	$\Delta \hat{c}_{jT+2}$	0.11603	0.21840	1.00000	
	Δc_{jT+2}	-0.03683	-0.11606	**0.32365**	1.00000

Horizon T+3

Variable	N	Simple Statistics Mean	Std Dev	Sum	Minimum	Maximum
$\Delta \hat{y}_{jT+3}$	79	3.51000	4.27596	277.29000	-2.70000	19.50000
Δy_{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
Δc_{jT+3}	79	-1.37587	12.09842	-108.69398	-81.569321	21.75981

Correlations:		$\Delta \hat{y}_{jT+3}$	Δy_{jT+3}	$\Delta \hat{c}_{jT+3}$	Δc_{jT+3}
	$\Delta \hat{y}_{jT+3}$	1.00000			
	Δy_{jT+3}	**0.55890**	1.00000		
	$\Delta \hat{c}_{jT+3}$	0.14194	-0.12499	1.00000	
	Δc_{jT+3}	-0.02829	0.01113	**0.38530**	1.00000

Table 2a: Regression Results, Historical Current and Fiscal Account Ratios, Horizon T

	Δy_{jT}		Δc_{jT}		Δy_{jT}		Δc_{jT}	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
Δc_{jT}	0.28 **	(0.06)			0.25 **	(0.05)		
Δy_{jT-1}	0.25 **	(0.10)	-0.08	(0.19)	0.23 **	(0.10)	-0.04	(0.20)
Δc_{jT-1}	-0.05	(0.05)	-0.04	(0.10)	-0.02	(0.05)	-0.23 **	(0.09)
Δy_{jT-2}	0.16 **	(0.08)	-0.01	(0.16)	0.14 *	(0.08)	0.13	(0.16)
Δc_{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 90 percent level of confidence.
** Indicates significance at the 95 percent confidence level.

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

	Δy_{jT+1}		Δc_{jT+1}		Δy_{jT+1}		Δc_{jT+1}	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
Δc_{jT+1}	0.142 **	(0.06)			0.124 **	(0.05)		(0.26)
Δy_{jT-1}	0.093	(0.11)	-0.145	(0.24)	0.079	(0.10)	0.012	(0.12)
Δc_{jT-1}	-0.036	(0.07)	-0.115	(0.16)	-0.006	(0.06)	-0.547 ***	
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 90 percent level of confidence.
** Indicates significance at the 95 percent confidence level.
*** Indicates significance at the 99 percent confidence level
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 90 percent level of confidence.
** Indicates significance at the 95 percent confidence level.

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 90 percent level of confidence.
** Indicates significance at the 95 percent confidence level.
*** Indicates significance at the 99 percent confidence level.

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

	$\Delta\hat{c}_{jT} - \Delta c_{jT}$ OLS	$\Delta\hat{c}_{jT} - \Delta c_{jT}$ 2SLS		$\Delta\hat{y}_{jT} - \Delta y_T$ OLS	$\Delta\hat{y}_{jT} - \Delta y_T$ 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 **
Δe_{jT}	-0.0003	-0.002	Δe_{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
			Δw_{jT}	0.10 **	0.02
			$\Delta\hat{w}_{jT}-\Delta w_{jT}$	-0.47 **	-0.47 **
			Δc_{jT-1}	0.03	0.03
			Δy_{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 Δe_T, $\Delta\hat{e}_T$-Δe_T, Δw_T and $\Delta\hat{w}_T$-Δw_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.

	$\Delta\hat{e}_{jT}-\Delta e_{jT}$ OLS	$\Delta\hat{e}_{jT}-\Delta e_{jT}$ OLS		$\Delta\hat{w}_{jT}-\Delta w_{jT}$ OLS	$\Delta\hat{w}_{jT}-\Delta w_{jT}$ 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
Δe_{jT-1}	-0.03 **	-0.05 **	w_{jT-1}	0.15 **	0.14 **
			Δw_{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

	Δe_{jT} OLS	Δe_{jT} OLS		Δw_{jT} OLS	Δw_{jT} OLS
Δe_{jT-1}	0.01**	0.03**	w_{jT-1}	-0.39**	-0.38**
c_{jT-1}	-0.10	0.04	Δw_{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 90 percent level of confidence. Standard errors and other regression statistics are available from the authors on demand.
** Indicates significance at the 95 percent level of confidence.

Table 5a: Forecast Error Components: Current Account Ratios

Variable	Coeff.	Mean	Effect	Percent effect	Total percent effect by type
c_{jT-1}	0.04	-6.64	-0.25	25.46	
y_{jT-1}	-0.02	-4.39	0.08	-8.23	
Δe_{jT}	0.00	-3.14	0.01	-0.60	Differences in modeling: 16.63 percent
$(\hat{c}_{jT-1} - c_{jT-1})$	-0.31	1.26	-0.40	40.38	Mismeasurement of initial conditions: 44.55 percent
$(\hat{y}_{jT-1} - y_{jT-1})$	-0.25	0.16	-0.04	4.17	
$(\Delta\hat{e}_{jT} - \Delta e_{jT})$	0.00	8.46	-0.01	0.85	Differences in policy response: 0.85 percent
t93	0.97	0.10	0.10	-10.43	
t94	0.37	0.15	0.06	-5.78	
t95	1.14	0.14	0.16	-16.54	
t96	1.99	0.11	0.22	-22.60	
t97	1.84	0.11	0.20	-20.83	Year specific: -125.53 percent
t98	3.35	0.10	0.35	-35.93	
t99	1.31	0.11	0.15	-14.90	
t00	0.50	0.10	0.05	-5.37	
t01	-1.21	0.06	-0.07	6.85	
Country dummies					Country-specific: 163.50 percent
$\Delta\hat{c}_{jT} - \Delta c_{jT}$		**-0.98**			
Total:			**-0.98**	**100**	**100 percent**
Nobs:			**162**		

Table 5b: Forecast Error Components: Fiscal Balance Ratios

Variable	Coeff.	Mean	Effect	Percent effect	Total percent effect by type
c_{jT-1}	-0.10	-6.64	0.68	265.67	
Δc_{jT-1}	0.03	-0.57	-0.01	-5.63	
y_{jT-1}	0.04	-4.39	-0.19	-74.68	
Δy_{jT-1}	-0.08	0.10	-0.01	-3.03	
Δe_{jT}	0.01	-3.14	-0.04	-14.43	
Δw_{jT}	0.02	-0.28	0.00	-1.73	Differences in modeling: 166.17 percent
$(\hat{c}_{jT-1} - c_{jT-1})$	-0.07	1.26	-0.09	-33.98	Mismeasurement of initial conditions:
$(\hat{y}_{jT-1} - y_{jT-1})$	-0.30	0.16	-0.05	-18.80	-52.78 percent
$\Delta\hat{e}_{jT}$-Δe_{jT}	0.01	8.46	0.07	28.22	
$\Delta\hat{w}_{jT}$-Δw_{jT}	-0.47	0.07	-0.03	-12.24	Differences in policy response: 15.99 percent
t93	-0.12	0.10	-0.01	-4.77	
t94	0.42	0.15	0.06	25.34	
t95	1.19	0.14	0.17	66.65	
t96	-0.11	0.11	-0.01	-4.96	
t97	0.08	0.11	0.01	3.38	
t98	0.35	0.10	0.04	14.53	
t99	1.30	0.11	0.14	56.64	
t00	0.42	0.10	0.04	17.40	
t01	0.36	0.06	0.02	7.87	Year-specific variables: 182.08 percent
Country dummies	-1.36	0.01	-0.02	-6.60	Country-specific variables: -211.46 percent
$\Delta\hat{y}_{jT}$ - Δy_T		**0.25**			
Total:			**0.25**	**100**	**100 percent**
Nobs:				**162**	

Table 6: Projecting the Change in Macroeconomic Aggregates (OP vs. FR)

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
Horison T						
$\Delta \hat{c}_{jT}^{FR}$	120	0.18624	3.67482	22.34863	-11.25961	14.09314
$\Delta \hat{c}_{jT}^{OP}$	120	-0.26392	3.25906	-31.66988	-13.89236	9.14219
Δc_{jT}	120	0.64113	4.33661	76.93582	-16.63708	14.29500
$\Delta \hat{c}_{jT}^{FR}$	120	1.21250	2.68248	145.50000	-5.50000	9.40000
$\Delta \hat{c}_{jT}^{OP}$	120	0.92700	2.82961	111.24000	-7.60000	11.00000
Δy_{jT}	120	0.97491	2.95418	116.98875	-6.27027	12.72751
Horizon T+1						
$\Delta \hat{c}_{jT+1}^{FR}$	95	-0.74583	5.81160	-70.85403	-26.17494	11.90127
$\Delta \hat{c}_{jT}^{OP}$	95	-0.81342	5.31906	-77.27518	-22.23187	11.90477
Δc_{jT}	95	-0.39908	7.35763	-37.91262	-35.61176	17.19095
$\Delta \hat{c}_{jT+1}^{FR}$	95	1.27189	3.35196	120.83000	-5.60000	13.30000
$\Delta \hat{c}_{jT}^{OP}$	95	1.40253	3.18396	133.24000	-5.60000	12.90000
Δc_{jT}	95	1.05813	3.75009	100.52207	-6.76704	13.69233

Table 6 (continued): Projecting the Change in Macroeconomic Aggregates (OP vs. FR)

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
Horizon T+2						
$\Delta \hat{c}^{FR}_{jT+2}$	74	-0.31151	5.18034	-23.05211	-17.31635	11.10499
$\Delta \hat{c}^{OP}_{jT+2}$	74	-0.22570	4.91495	-16.70172	-22.04280	10.81110
Δc_{jT+2}	74	-0.37456	8.12439	-27.71773	-38.14743	21.78397
$\Delta \hat{c}^{FR}_{jT+2}$	74	1.98784	3.49077	147.10000	-4.70000	13.50000
$\Delta \hat{c}^{OP}_{jT+2}$	74	2.27838	3.15904	168.60000	-3.30000	13.20000
Δc_{jT+2}	74	1.51000	4.07910	111.73996	-14.88070	11.88877
Horizon T+3						
$\Delta \hat{c}^{FR}_{jT+3}$	50	0.31151	5.18034	-23.05211	-17.31635	11.10499
$\Delta \hat{c}^{OP}_{jT+3}$	50	-0.22570	4.91495	-16.70172	-22.04280	10.81110
Δc_{jT+2}	50	-2.07739	14.24848	-103.86963	-81.56932	21.40533
$\Delta \hat{c}^{FR}_{jT+3}$	50	2.96400	4.02060	148.20000	-3.90000	13.10000
$\Delta \hat{c}^{OP}_{jT+3}$	50	3.11580	3.52157	155.79000	-1.90000	13.00000
Δc_{jT+2}	50	1.48644	4.21497	74.32213	-12.33862	11.64537

Table 7: Correlations Between Projected and Actual Outcomes for the Changes in Macroeconomic Aggregates (OP vs. FR)

Horizons	T	T+1	T+2	T+3
Fiscal ratio ($\Delta y_{jk}, \Delta \hat{y}_{jk}^{FR}$)	0.69635	0.76157	0.70624	0.60535
Fiscal ratio ($\Delta y_{jk}, \Delta \hat{y}_{jk}^{OP}$)	0.60742	0.69037	0.65761	0.57322
Correlation improvement (ρ_y^{FR} - ρ_y^{OP})	0.08893	0.0712	0.04863	0.03213
Current-account ratio ($\Delta c_{jk}, \Delta \hat{c}_{jk}^{FR}$)	0.69175	0.46345	0.33955	0.35714
Current-account ratio ($\Delta c_{jk}, \Delta \hat{c}_{jk}^{OP}$)	0.50390	0.34193	0.30747	0.35449
Correlation improvement (ρ_c^{FR} - ρ_c^{OP})	0.18785	0.12152	0.03208	0.00265

Table 8: Program Projection Errors

Horizon		T	T+1	T+2	T+3
Projection errors in changes of fiscal balance ratios to GDP					
Mean	OP	0.048	-0.492**	-1.334*	-1.809*
	FR	-0.238	-0.252	-0.543	-1.478*
Median	OP	-0.014	-0.492	-0.786	-1.541
	FR	-0.232	-0.341	-0.548	-1.728
Standard Deviation	OP	2.565	2.852	4.070	3.673
	FR	2.211	2.471	2.952	3.663
Skewness	OP	0.028	-0.009	-2.406	-1.582
	FR	0.827	0.312	-1.731	-1.591
Kurtosis	OP	4.32	1.636	10.100	4.747
	FR	6.142	1.057	9.812	6.467
Normality Test	OP	Rejected	Mixed (3/4)	Rejected	Rejected
	FR	Rejected	Mixed (3/4)	Mixed (1/4)	Mixed (2/4)
Projection errors in changes of current account ratios to GDP					
Mean	OP	0.905*	0.258	-0.595	-2.176
	FR	0.455	0.262	-0.222	-2.220
Median	OP	0.583	0.669	-0.614	-0.666
	FR	0.281	0.410	-0.228	-0.994
Standard Deviation	OP	3.897	7.260	7.766	12.492
	FR	3.204	6.824	7.832	12.726
Skewness	OP	1.222	-2.630	-2.555	-4.612
	FR	0.241	-3.405	-3.072	-4.702
Kurtosis	OP	5.442	17.961	17.032	29.405
	FR	1.825	24.079	18.618	29.359
Normality Test	OP	Rejected	Rejected	Rejected	Rejected
	FR	Rejected	Mixed (1/4)	Rejected	Rejected

* - Significantly different from zero at the 95 percent confidence level (based on Student's t-test)

** - Significantly different from zero at the 90 percent confidence level (based on Student's t-test)

Mixed (X/4) – X out of four tests cannot reject normality of the error terms at the 95 percent confidence level.

Table 9: Test of “Weak” Efficiency
(In changes)

	Original Program			First Review		
	Coeff.	Std. Dev.	t-statistic	Coeff.	Std. Dev.	t-statistic
Fiscal Balance Ratios			Horizon: T			
Intercept (Ho: Intercept=0)	0.387*	0.227	1.709	0.045	0.214	0.210
Slope (Ho: Slope =1)	0.634***	0.076	-4.792	0.767***	0.073	-3.192
R^2		**0.369**			**0.485**	
			Horizon: T+1			
Intercept (Ho: Intercept=0)	-0.084	0.296	-0.284	-0.056	0.265	-0.211
Slope (Ho: Slope =1)	0.731***	0.082	-3.281	0.848**	0.075	-2.027
R^2		**0.439**			**0.577**	
			Horizon: T+2			
Intercept (Ho: Intercept=0)	-0.168	0.498	-0.337	-0.182	0.379	-0.480
Slope (Ho: Slope =1)	0.542***	0.114	-4.018	0.814**	0.096	-1.938
R^2		**0.211**			**0.492**	
			Horizon: T+3			
Intercept (Ho: Intercept=0)	-0.804	0.613	-1.312	-0.395	0.598	-0.661
Slope (Ho: Slope =1)	0.704**	0.12	-2.467	0.635***	0.12	-3.042
R^2		**0.377**			**0.366**	
Current Account Ratios			Horizon: T			
Intercept (Ho: Intercept=0)	0.818**	0.345	2.371	0.489*	0.288	1.698
Slope (Ho: Slope =1)	0.671***	0.106	-3.104	0.816**	0.079	-2.329
R^2		**0.254**			**0.479**	
			Horizon: T+1			
Intercept (Ho: Intercept=0)	-0.096	0.671	-0.143	-0.006	0.650	-0.009
Slope (Ho: Slope =1)	0.467***	0.130	-4.100	0.583***	0.113	-3.690
R^2		**0.114**			**0.215**	
			Horizon: T+2			
Intercept (Ho: Intercept=0)	-0.568	0.803	-0.707	-0.365	0.850	-0.429
Slope (Ho: Slope =1)	0.507***	0.169	-2.917	0.550***	0.169	-2.663
R^2		**0.097**			**0.120**	
			Horizon: T+3			
Intercept (Ho: Intercept=0)	-2.183	1.649	-1.324	-2.221	1.734	-1.281
Slope (Ho: Slope =1)	1.016	0.353	0.045	1.004	0.350	0.011
R^2		**0.127**			**0.134**	

* - The null can be rejected at the 90 percent confidence level.
** - The null can be rejected at the 95 percent confidence level.
*** - The null can be rejected at the 99 percent confidence level.

Table 10: Test of "Weak" Efficiency
(In levels)

	Original Program			First Review		
	Coeff.	Std. Dev.	t-statistic	Coeff.	Std. Dev.	t-statistic
Fiscal Balance Ratios			Year: T			
Intercept (Ho: Intercept=0)	-1.870***	0.345	-5.420	-1.483***	0.297	-4.993
Slope (Ho: Slope =1)	0.493***	0.076	-6.671	0.685***	0.071	-4.437
R^2		**0.263**			**0.437**	
Current Account Ratios			Year: T			
Intercept (Ho: Intercept=0)	-1.529**	0.694	-2.203	-1.121**	0.529	-2.119
Slope (Ho: Slope =1)	0.706***	0.101	-2.911	0.912	0.081	-1.086
R^2		**0.289**			**0.512**	

* - The null can be rejected at the 90 percent confidence level.
** - The null can be rejected at the 95 percent confidence level.
*** - The null can be rejected at the 99 percent confidence level.

Table 11: Test of Accuracy
(In levels)

		A Theil's U statistic	
Projection Model	Number of observations	Fiscal balance ratios	Current account ratios
Original Program	121	0.695	0.696
Benchmark for OP (random walk)	121	0.788	0.639
First Review	120	0.571	0.568
Benchmark for FR (random walk)	120	0.760	0.635

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.

Does the Timing of Approval of IMF-Supported Programs Matter to These Results?

Projection errors, especially for the initial program year (year T), may reasonably be hypothesized to depend on the point in time during the year when a program was approved. 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 provide no evidence of a significant approval-time effect in either variable. For the fiscal ratio, there is no evidence of a significant approval-time effect for either OP or FR projection errors. 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. There is no evidence of a significant effect in the Pearson correlations. There is some evidence of this in the regression results, however. For both OP and FR versions of the fiscal ratio and the OP version of the current-account ratio, the deviation in initial conditions is significantly larger 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.

If there is a value to this information, it should also be evident in the initial conditions as reported in FR relative to OP for each program. In Table C5 we compare the initial conditions, with deviations measured as FR values minus OP values. A similar regression on approval-times within year T yields little evidence of a systematic bias, with only the current-account ratio showing any deviation of significance. The estimated coefficients are suggestive, though, rising from negative values for quarter-one approval to ever-increasing values for subsequent quarters.

Table C1: Pearson correlations for projection errors.

	Fiscal balance: Original program. Approval Month in T	Fiscal balance: First review. Approval month in T	Current account: Original program. Approval month in T	Current account First review Approval month in T
Horizon T	0.01905	-0.02677	0.00687	0.06711
	0.8364	0.7716	0.9406	0.4665
	120	120	120	120
Horizon T+1	-0.05439	-0.15750	0.14289	0.14916
	0.5853	0.1234	0.1499	0.1406
	103	97	103	99

Table C2: Regressions on quarterly dummies (horizon T) for projection errors.

	Fiscal balance (OP)	Fiscal balance (FR)	Current Account (OP)	Current Account (FR)
Quarter 1	0.06	-0.11	0.44	-0.15
	(0.46)	(0.40)	(0.69)	(0.57)
Quarter 2	-0.27	-0.47	1.08*	0.94*
	(0.39)	(0.34)	(0.60)	(0.49)
Quarter 3	0.26	-0.16	1.76**	0.26
	(0.51)	(0.44)	(0.77)	(0.63)
Quarter 4	0.44	-0.04	0.13	0.63
	(0.59)	(0.51)	(0.90)	(0.74)
R^2	0.01	0.02	0.07	0.04
N	120	120	120	120

Table C3: Pearson correlations for discrepancies in initial conditions (actual - projection).

	Fiscal balance: Original program. Approval Month in T	Fiscal balance: First review. Approval month in T	Current account: Original program. Approval month in T	Current account First review Approval month in T
All horizons	0.13744	0.10628	0.09385	-0.11611
	0.1328	0.2440	0.3076	0.2028
	121	122	120	122

Table C4: Regressions on quarterly dummies for discrepancies in initial conditions

	Fiscal balance (OP)	Fiscal balance (FR)	Current Account (OP)	Current Account (FR)
Quarter 1	-0.80**	-0.73**	-1.75**	1.56
	(0.39)	(0.35)	(0.73)	(1.11)
Quarter 2	-0.37	-0.40	-0.95	-0.82
	(0.34)	(0.31)	(0.63)	(0.96)
Quarter 3	0.27	0.05	-0.75	0.62
	(0.44)	(0.39)	(0.82)	(1.23)
Quarter 4	-0.18	-0.21	-0.34	-2.17
	(0.51)	(0.46)	(0.95)	(1.44)
R^2	0.05	0.05	0.07	0.04
N	120	120	120	120

Table C5: Regressions on quarterly dummies (horizon T) for differences in initial conditions between first review (FR) and original program (OP).

	Fiscal balance (FR-OP)	Current Account (FR-OP)
Quarter 1	-0.072	-0.176
	(0.171)	(0.367)
Quarter 2	0.023	0.074
	(0.148)	(0.317)
Quarter 3	0.215	0.323
	(0.190)	(0.408)
Quarter 4	0.032	0.904*
	(0.222)	(0.477)
R^2	0.013	0.039
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.

What New Information Do Revisions Incorporate?

The results in the text suggest that the IMF staff modifies its projections to incorporate new information and that the revised projections have better forecasting power relative to the original program. However, it is not yet clear whether this is a reflection of adjusting projections for new values of the initial conditions that contain less measurement error, or a sign of using new information to modify the entire scope of the model used in projection. We choose to address this issue by estimating regressions of the following general form:

$$\Delta \hat{g}^{OP}_{jT} = a_1 \Delta \hat{g}^{OP}_{jT-1} + a_2 \hat{g}^{OP}_{jT-1} + b_1 \Delta \hat{s}^{OP}_{jT} + v^{OP}_{jT} \quad \text{(D1)}$$

$$\Delta \hat{g}^{FR}_{jT} = \tilde{a}_1 \Delta \hat{g}^{FR}_{jT-1} + \tilde{a}_2 \hat{g}^{FR}_{jT-1} + \tilde{b}_1 \Delta \hat{s}^{FR}_{jT} + v^{FR}_{jT} \quad \text{(D2)}$$

The form is the same as that advanced in the previous section. The difference in projections can be stated in somewhat different form in equation (D3). When we subtract (D1) from (D2), we note four different reasons why the two projections will not be the same: an updating of information on past events (in the first square bracket of (D3)), increased information on policy implementation, a change in the "model" used in projection (the second square bracket in (D3)), and projection errors.

$$\Delta \hat{g}^{FR}_{jT} = \Delta \hat{g}^{OP}_{jT} + \left[\tilde{a}_1 (\Delta \hat{g}^{FR}_{jT-k} - \Delta \hat{g}^{OP}_{jT-k}) + \tilde{a}_2 (\hat{g}^{FR}_{jT-1} - \hat{g}^{OP}_{jT-1}) \right] + \tilde{b}_1 (\Delta \hat{s}^{FR}_{jT} - \Delta \hat{s}^{OP}_{jT})$$
$$+ \left[(\tilde{a}_1 - a_1) \Delta \hat{g}^{OP}_{jT-1} + (\tilde{a}_2 - a_2) \hat{g}^{OP}_{jT-1} + (\tilde{b}_1 - b_1) \Delta \hat{s}^{OP}_{jT} \right] + (v^{FR}_{jT} - v^{OP}_{jT}) \quad \text{(D3)}$$

Here, we regress projected changes in the macroeconomic variable as projected in the first review of the program ($\Delta \hat{g}^{FR}_{jT}$) on the projected change of the variable as it was originally planned at the outset of the program ($\Delta \hat{g}^{OP}_{jT}$) and on the terms reflecting improvement of the information on the initial conditions ($\Delta \hat{g}^{FR}_{jT-k} - \Delta \hat{g}^{OP}_{jT-k}$) and ($\hat{g}^{FR}_{jT-1} - \hat{g}^{OP}_{jT-1}$). We also incorporate a term representing differences in projected changes in policy variable, ($\Delta \hat{s}^{FR}_{jT} - \Delta \hat{s}^{OP}_{jT}$), to capture effects of changes implementation of conditions associated with the programs. Finally, all the terms in the second square parentheses are included to study whether the forecasting model has changed.

We predict that the value of the coefficient on $\Delta \hat{g}^{OP}_{jT}$ will be unity, as would be the case for example if the first review simply caused a mean-preserving contraction in the distribution of random errors. Values of $\tilde{a}_1$ and $\tilde{a}_2$ differing significantly from zero will indicate that the revision observed in FR reflects the improved information about the initial conditions governing the economic success of the program. Figure D1 illustrates the interpretation of this model. For $\tilde{a}_1$ and $\tilde{a}_2$ significantly different from zero and coefficient on $\Delta \hat{g}^{OP}_{jT}$ being unity, the revision should trigger the "Old model, New initial conditions" scenario pictured there. However, if the new information available during implementation of the program called for correction of the entire projection model then the coefficients on $\Delta \hat{g}^{OP}_{jT-1}$, $\hat{g}^{OP}_{jT-1}$, and $\Delta \hat{s}^{OP}_{jT}$ will be significantly different from zero and the estimates would follow the "New model, New initial conditions" scenario in Figure D1.

Table D1 summarizes the results of the model estimation for the ratio of fiscal balances to GDP for all programs in the sample at horizon T. Changes in fiscal ratios as they are projected in the first reviews of the programs are regressed not only on terms representing the error-correction structure of fiscal ratios but also on the similar terms corresponding to the current account ratios. A complete set of time and country dummy variables was also included in the regressions. The following insights can be obtained from the first column of the Table D1:

- The value of the coefficient on $\Delta \hat{y}^{OP}_{jT}$ is 0.986, which is not statistically different from unity. This could be interpreted as if the correction of the projection reported in the first review of the program is just a modification of the projection due to the more accurate initial conditions. The updated information set available at the moment of revision is incorporated into the same projection model that was used to create OP projections. This result is consistent with the fact that none of the terms included to capture projection model modification is significantly different from zero.

- The coefficient on $(\Delta \hat{y}^{FR}_{jT-1} - \Delta \hat{y}^{OP}_{jT-1})$ is negative and significant. One of the potential explanations of this fact can be outlined as follows. Suppose that reduction of the measurement error results in an improvement in the fiscal balance in the years preceding the program relative to what it has been originally thought when the program was designed. That would mean that $(\Delta \hat{y}^{FR}_{jT-1} - \Delta \hat{y}^{OP}_{jT-1})$ is a positive number. Given our finding, this would result in a reduction of the projected change in the fiscal ratio projected in the first review of the program. Moreover, the value of the coefficient, -0.973, is not significantly different from negative one, which suggests that this is a one to one relationship. This finding makes intuitive economic sense because if the government's budget deficit is not as bad as it was originally thought then the required correction of the fiscal balance is also less demanding.

- Specification testing reveals that changes in lagged first-difference terms with lag length greater than one do not contribute significantly to the regression. At the same time, none of the current account ratio terms is significantly different from zero, which suggests that improvement in the data quality of the current account has little effect on the projections of the fiscal ratios.

- The coefficient on the difference in the policy variable, $(\Delta \hat{s}^{FR}_{jT} - \Delta \hat{s}^{OP}_{jT})$, is negative and significant implying that differences in policy between OP and FR are also responsible for the amendments of the original projections. Moreover, the negative sign of this coefficient suggests that a greater observed real depreciation results in less positive forecasts of changes in fiscal balance ratios[29].

- Finally, testing jointly that both lagged level terms are not significantly different from zero allows us to conclude that revisions to initial conditions do not contribute systematically to the changes observed in FR relative to OP.

The second column of Table D2 reports results of the estimation of a similar model when the lagged level terms are excluded from the regression.

- The coefficient on $\Delta \hat{y}^{OP}_{jT}$ is still insignificantly different from unity and the hypothesis that the IMF staff does not modify the projection model as the new information arrives is strongly supported by the data.

- At the same time, the coefficient on $\Delta \hat{e}^{OP}_{jT}$ is significantly different from zero at 90 percent confidence level providing some support of the hypothesis that the scope of the projecting model was amended.

- The coefficient on $(\Delta \hat{y}^{FR}_{jT-1} - \Delta \hat{y}^{OP}_{jT-1})$ is still negative although much smaller in the absolute value.

- The policy variable coefficient is still significantly different from zero.

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[29] Although it would be more reasonable to use total government expenditure as a policy variable in the regression for fiscal balances, the number of observations available for the first reviews limits the use of this variable as a proxy for policy variable.

Similarly, Table D2 presents outcomes of the model estimation for the current-account ratios for all programs in the sample at horizon T. Once again, we regress changes in current account ratios from the first reviews of the programs on terms representing the error correction structure of current account ratios and on the similar terms corresponding to the fiscal ratios, as well as on the policy variable and the set of time and country dummies. The first column of the table represents the case when the error-correction terms are included into regression:

- The value of the coefficient on the originally projected change in current account, $\Delta \hat{c}^{OP}_{jT}$, is 0.411 and the null hypothesis of the true value of this coefficient being unity is rejected at the 99 percent confidence level. Unlike our result for the case of fiscal ratio projections, the projected change in current account ratio in the revision of the program appears to be derived under a different model relative to the change in current account projected in the beginning of the program.

- Modification of the projection model is also strongly supported by the fact that the coefficient on $\hat{c}^{OP}_{jT-1}$ is significant at 99 percent confidence level.

Excluding the lagged level terms from the regression gives us a slightly better understanding of the relationship between the considered variables.

- The coefficient on the originally projected change in current account, $\Delta \hat{c}^{OP}_{jT}$, is still significantly different from unity at the 99 percent confidence level and takes the value of 0.439. Thus, we still find strong support for distinguishing between the original program and first review projection models.

- However, one of the terms representing changes in the initial conditions for fiscal ratio, $(\Delta \hat{y}^{FR}_{jT-2} - \Delta \hat{y}^{OP}_{jT-2})$, is significantly different from zero at the 90 percent confidence level with the value of the coefficient of –1.279. This suggests that the projection of the current account ratio is significantly affected by the changes in the initial conditions of the fiscal balance ratios. Moreover, the sign of the estimated coefficients indicate that an improvement in the initial conditions of the fiscal balance relative to what it was originally assumed when the program was designed induces a reduction in the projected change in the current account for some given values of the other variables. This result is supported by our previous finding that the coefficient on $(\Delta \hat{y}^{FR}_{jT-1} - \Delta \hat{y}^{OP}_{jT-1})$ in the regression of fiscal balances reported in Table D1 is negative. To illustrate this suppose that reduction of the measurement error results in the improvement of the fiscal balance initial conditions relative to what had been originally thought when the program was designed implying that $(\Delta \hat{y}^{FR}_{jT-1} - \Delta \hat{y}^{OP}_{jT-1})$ is positive. Since the coefficient on this term is negative, this would result in the reduction of the projected change in the fiscal ratio projected in the first review of the program, $\Delta \hat{y}_{jT}^{FR}$. Then the macro identity written in the first-difference form, $\Delta \hat{y}_{jT}^{FR} = \Delta \hat{c}_{jT}^{FR} - \Delta \hat{p}_{jT}^{FR}$, suggests that for any given value of private saving, $\Delta \hat{p}_{jT}^{FR}$, the projected change in the current account, $\Delta \hat{c}_{jT}^{FR}$, also reduces. This decrease in current account ratio as a result of improvement in the initial conditions for fiscal ratios is captured in our model by the negative sign of the coefficient on the corresponding terms.

Our analysis shows that the correction in the initial conditions has a strong influence on the magnitude of the projections for both fiscal and current account ratios. Therefore, it appears to be logical to look at the magnitude of those corrections and their distribution. Figures D2 and D3 illustrate the distribution of the corrections in the levels of fiscal balance ratio to GDP and the distribution of the corrections in the levels of current account ratio to GDP respectively for the year T-1. These corrections are large, varying between –5.3 and 4.6 percent of GDP for fiscal ratios and between –9.3 and 8.1 percent of GDP for current account ratios. The mass of the distributions is concentrated around zero. The negative skew in both cases shows that the corrections of the initial conditions are more likely to be far below the mean than they are to be far above the mean. Also, both distributions have kurtosis that exceeds 3, which implies that they have more mass in the tails than a Gaussian distribution with the same variance. Table D4 reports results of the goodness-of-fit tests for the normal distribution. All the tests strongly reject the null of the initial condition corrections having a Gaussian distribution.

Table D1: Regression results, fiscal account ratios
(First review vs. original program)

	$\Delta\,\hat{y}_{jT}^{FR}$		$\Delta\,\hat{y}_{jT}^{FR}$	
	Coefficient	S.E.	Coefficient	S.E.
$\Delta\hat{y}_{jT}^{OP}$	0.986***	0.141	0.970***	0.130
$(\Delta\hat{c}_{jT}^{FR} - \Delta\hat{c}_{jT}^{OP})$	0.040	0.137	0.047	0.124
$(\Delta\hat{y}_{jT-1}^{FR} - \Delta\hat{y}_{jT-1}^{OP})$	-0.973***	0.357	-0.756***	0.271
$(\Delta\hat{c}_{jT-1}^{FR} - \Delta\hat{c}_{jT-1}^{OP})$	0.314	0.237	0.210	0.224
$(\Delta\hat{y}_{jT-2}^{FR} - \Delta\hat{y}_{jT-2}^{OP})$	-0.350	0.406	-0.203	0.316
$(\Delta\hat{c}_{jT-2}^{FR} - \Delta\hat{c}_{jT-2}^{OP})$	-0.246	0.221	-0.206	0.192
$(\hat{y}_{jT-1}^{FR} - \hat{y}_{jT-1}^{OP})$	0.211	0.553		
$(\hat{c}_{jT-1}^{FR} - \hat{c}_{jT-1}^{OP})$	-0.308	0.209		
$\Delta\hat{y}_{jT-1}^{OP}$	0.075	0.087	0.035	0.076
$\hat{y}_{jT-1}^{OP}$	-0.043	0.133	-0.066	0.114
$\hat{e}_{jT}^{OP}$	-0.009	0.008	-0.012*	0.007
$(\Delta\hat{e}_{jT}^{FR} - \Delta\hat{e}_{jT}^{OP})$	-0.045***	0.016	-0.041***	0.016
N	91		91	
R^2	0.988		0.986	
Adjusted R^2	0.926		0.925	

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

* - Significantly different from zero at the 90 percent confidence level.
** - Significantly different from zero at the 95 percent confidence level.
*** - Significantly different from zero at the 99 percent confidence level.

A complete set of time and country dummies were included in the regressions, but their coefficients are suppressed for brevity.

Table D2: Regression results, current account ratios
(First review vs. original program)

	$\Delta\,\hat{c}_{jT}^{FR}$		$\Delta\,\hat{c}_{jT}^{FR}$	
	Coefficient	S.E.	Coefficient	S.E.
$\Delta\hat{c}_{jT}^{OP}$	0.411*,+++	0.234	0.439***,+++	0.207
$(\Delta\hat{y}_{jT-1}^{FR} - \Delta\hat{y}_{jT-1}^{OP})$	-0.194	1.037	-0.211	0.666
$(\Delta\hat{c}_{jT-1}^{FR} - \Delta\hat{c}_{jT-1}^{OP})$	-0.297	0.691	-0.171	0.547
$(\Delta\hat{y}_{jT-2}^{FR} - \Delta\hat{y}_{jT-2}^{OP})$	-1.099	0.939	-1.279*	0.728
$(\Delta\hat{c}_{jT-2}^{FR} - \Delta\hat{c}_{jT-2}^{OP})$	0.037	0.474	0.084	0.428
$(\hat{y}_{jT-1}^{FR} - \hat{y}_{jT-1}^{OP})$	0.185	1.250		
$(\hat{c}_{jT-1}^{FR} - \hat{c}_{jT-1}^{OP})$	0.178	0.586		
$\Delta\hat{c}_{jT-1}^{OP}$	-0.085	0.201	-0.066	0.180
$\hat{c}_{jT-1}^{OP}$	-0.366***	0.142	-0.382***	0.126
$\hat{e}_{jT}^{OP}$	0.013	0.012	0.013	0.011
$(\Delta\hat{e}_{jT}^{FR} - \Delta\hat{e}_{jT}^{OP})$	-0.018	0.043	-0.025	0.036
N	91		91	
R^2	0.939		0.938	
Adjusted R^2	0.651		0.688	

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

* - Significantly different from zero at the 90 percent confidence level.
** - Significantly different from zero at the 95 percent confidence level.
*** - Significantly different from zero at the 99 percent confidence level.

+ - Significantly different from unity at the 90 percent confidence level.
++ - Significantly different from unity at the 95 percent confidence level.
+++ - Significantly different from unity at the 99 percent confidence level.

A complete set of time and country dummies were included in the regressions, but their coefficients are suppressed for brevity.

Table D3: Goodness-of-Fit Tests for Normal Distribution for the Corrections in the Initial Conditions

Variable	Test	Statistic	P-value (H_0: normal)
$(y_{jt-1}^{FR} - y_{jt-1}^{OP})$	Kolmogorov-Smirnov	0.3179	<0.010
	Cramer-von Mises	3.9281	<0.005
	Anderson-Darling	18.6995	<0.005
	Chi-Square	17877.8796	<0.001
$(c_{jt-1}^{FR} - c_{jt-1}^{OP})$	Kolmogorov-Smirnov	0.24224	<0.010
	Cramer-von Mises	2.73701	<0.005
	Anderson-Darling	13.70785	<0.005
	Chi-Square	9843.90054	<0.001

Figure D1: Incorporation of the New Information in Projections

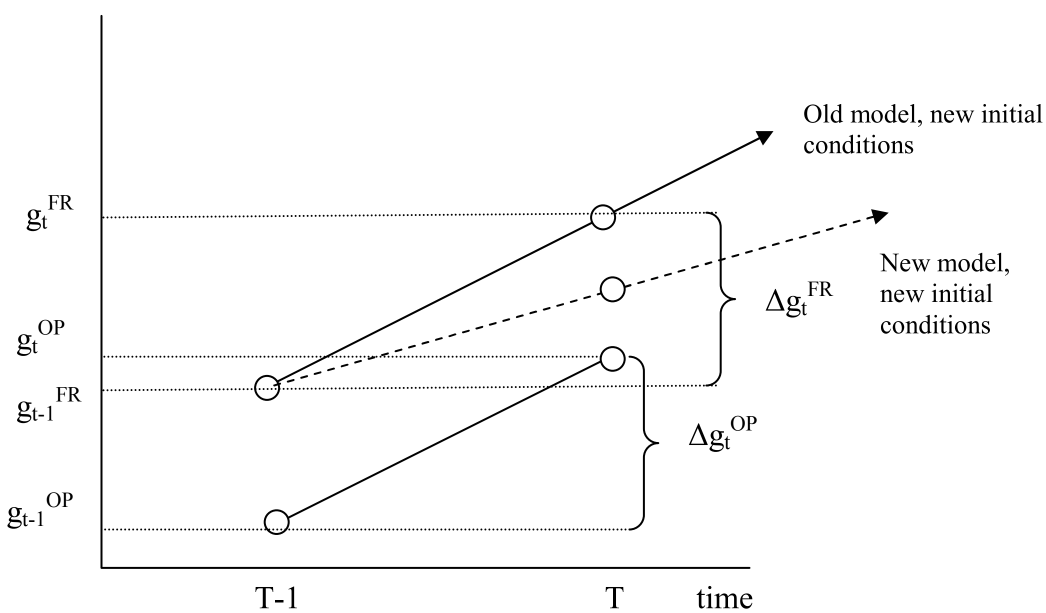

Figure D2

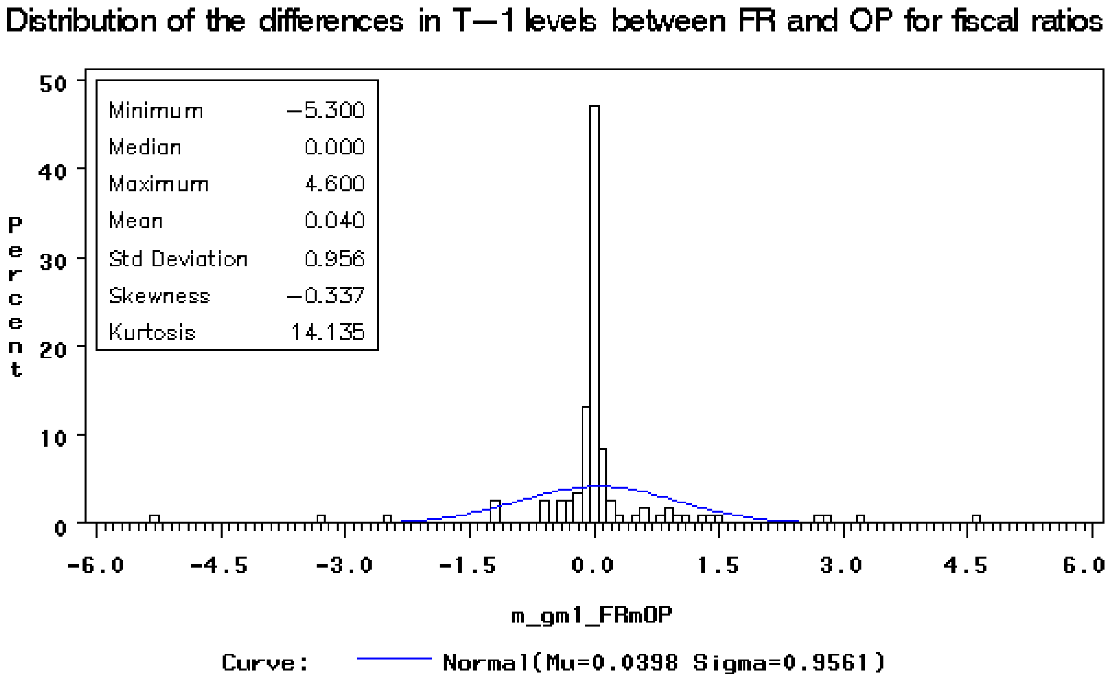

Figure D3