

WP/05/2

# IMF Working Paper

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## The Political Economy of Revenue-Forecasting Experience from Low-Income Countries

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and Annette Kyobe*

**IMF Working Paper**

Fiscal Affairs Department

**The Political Economy of Revenue-Forecasting  
Experience from Low-Income Countries**

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January 2005

**Abstract**

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This paper analyzes interference and timeliness in the revenue-forecasting process, using new data on revenue-forecasting practices in low-income countries. Interference is defined as the occurrence of a significant deviation from purely technical forecasts. A theoretical model explains forecasting interference through government corruption. The data broadly supports the model, and the results are robust to alternative explanations. The paper also constructs three indices—transparency, formality, and organizational simplicity—that characterize revenue-forecasting practices, and assesses their effectiveness in producing an upfront—that is, timely—budget envelope. More transparent and simple forecasting processes lead to early budget constraints, while formality has no measurable effect.

JEL Classification Numbers: H20

Keywords: revenue forecasting, corruption, forecasting bias

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<sup>1</sup> We would like to thank conference participants at the IMF's 2004 Panel of Experts Conference organized by the Fiscal Affairs Department and in particular Dilip Mookherjee, Eduardo Ley, and Rodney Ramcharan for insightful discussions and useful references. Editorial assistance by Anne Robertson is gratefully acknowledged.

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## INTRODUCTION

It is a well known fact that revenue forecasts are frequently “tweaked” during the budget preparation process. Often mentioned reasons for this practice are to build a cautious margin into forecasts or to improve public and market confidence through upbeat assessments. These arguments have cast some doubt on the commonly held view that revenue forecasts should not be adjusted, as this would create significant budget planning and management problems, reduce transparency, and erode credibility of fiscal policy.

The question of what constitutes an appropriate forecasting process is an important issue for low-income and emerging market economies. Low-income countries often have informal budget planning arrangements which provide room for forecasting interference. This paper explores to what extent the traditional call for unbiased revenue forecasts is still valid, and should be adhered to in low-income countries.

The paper defines forecasting interference as a significant deviation between budget estimates and technical forecasts. Aside from an IMF working paper on forecasting performance in low-income countries (Golosov and King, 2002), little other work has addressed forecasting interference in nonindustrial countries. Most empirical work relates to forecasting practices in U.S. state governments or focuses on an individual country’s forecasting performance (e.g., Australia, Canada, the U.K., Ireland, and the Netherlands). The findings in the literature are often contradictory and irrelevant to low-income countries; theoretical treatments on forecasting incentives relate primarily to private sector forecasters; and institutional aspects are seldom analyzed. This lack of information is somewhat disappointing, considering that the IMF is often asked to advise low-income countries on budget reforms, including forecasting processes and techniques, through technical assistance work and training programs.

The objective of this paper is threefold. First, it tries to fill some of the information gap on forecasting practices by presenting and discussing a new data set on revenue-forecasting practices in 34 low-income countries. Second, using this data set, the paper analyzes whether key forecasting characteristics lead to more timely and realistic budget estimates. Third, the paper presents a corruption-based model of forecasting interference, and tests the model against the data. The main findings are summarized below.

The data show surprisingly little variation in forecasting practices despite the heterogeneity of the countries surveyed. The majority of countries produce one-year budget estimates, which are limited to the central government, and based on simple extrapolation techniques—the use of econometric methods is rare. In most cases, forecasting lacks formal rules and tends to involve multiple government agencies. Transparency in terms of access to the forecasting process and information about the forecasting process itself is poor. Interference appears to be present in 36 percent of the sample countries.

Based on country experience, the paper identifies three main forecasting attributes—transparency, formality, and organizational simplicity. The paper then tests their impact on forecasting efficiency, here defined as timely identification of the budget resource envelope

prior to parliamentary budget submission. This parameter, expressed in months, is benchmarked against the six-month period identified by the OECD for nonindustrial countries (OECD, 2001). On average, countries in the sample have a much shorter forecasting cycle, leading to a late—hence, inefficient—identification of available resources in the budget formulation cycle. Organizational simplicity and transparency of the forecasting process tend to be associated with more efficient, timely forecasts. Past IMF involvement, measured either as the presence of an IMF-supported financial facility or technical assistance, appears to have no measurable effect on transparency or organizational simplicity, but leads to a more formal, rule-based forecasting process.

In developing a theoretical model of forecasting interference, the paper argues that interference is the result of government's superior information about the realization of a stochastic tax base. Due to the information asymmetry, covert interference in the forecasting process is possible. By adjusting forecasts downwards in periods of high revenue expectations, governments can conceal the extraction of resources without increasing forecast errors. Forecasting interference is thus welfare deteriorating, but does not affect the ex post forecast errors. The model builds on previous work linking institutions, governance, and economic developments (Bardhan, 1997; Tanzi and Davoodi, 2000), but emphasizes revenue forecasting as a specific channel for creating state capture. It adds to the literature on forecasting interference (Zellner, 1986; Danninger, 2004), but motivates intervention by rent seeking.

The corruption-based model of forecasting interference is broadly supported by the data and robust to different specifications. Among the alternative explanations for interference, expenditure demand pressures also appear to matter. This motive refers to a strategy whereby governments appease expenditure demands by adjusting the revenue forecast. The expenditure pressure motive does however not wipe out the corruption effect. The paper also examines the role of various forecasting practices, and finds that transparency reduces interference.

A few preliminary conclusions arise from this study. First, forecasting procedures are at a low standard in many countries. Relatively complex and nontransparent processes seem to undermine timely forecasts. Although formal rules are generally considered important, they do not appear to improve forecasting timeliness. Contrary to the argument of a beneficial bias, the empirical results seem to support a less benign corruption motive. The commonly held view that forecast interference should be avoided still prevails, but because of governance problems instead of its alleged tendency to generate forecast errors. Given that forecasting transparency seems to reduce interference, more emphasis should be given to information access and the greater participation of nongovernment institutions in revenue forecasting. On the whole, however, the empirical results should be interpreted with caution, given the small sample size and the use of subjective expert information in the analysis.

The remainder of the paper is structured as follows. Section one reviews relevant literature. Section two describes the data set, summarizes basic findings, and examines the role of forecasting transparency, formality, and organizational simplicity for forecasting efficiency.

Section three gives a definition of forecasting interference and presents a corruption-based model. The implications of the model and the roles of various forecasting practices on interference are tested in Section four. The last section concludes.

## I. LITERATURE REVIEW

This paper relates to three different strands of the literature. First, it complements a fairly small number of empirical studies on revenue-forecasting practices and performance, which are primarily concerned with industrial country experiences. Second, it adds to studies on the rationale of forecasting interference. Studies in this area have focused mainly on incentives of private forecasters; however, the current paper discusses public forecaster incentives. The third relevant aspect covers institutions, governance, and development. The paper adds to this body of work by presenting a new mechanism for generating state capture.

Most empirical research on revenue forecasts relates to the comparative experience of U.S. state governments, with only a few exceptions. One is Golosov and King (2002), who investigate revenue-forecasting performance in low-income countries under IMF concessional lending. They find that tax revenue forecasts as a percent of GDP are biased upwards and positively correlated to program interruptions and time passed since the inception of IMF lending. The paper does not, however, address the role of forecasting practices or institutional development.

The main sources for institutional factors are studies on the U.S. state governments, with mixed findings on biases and the role of political factors. Alt (1993) catalogues various U.S. state revenue estimation practices, and discusses the key agencies responsible for the forecasts, as well as the tools used in estimation. The paper is mainly descriptive, and documents a variety of different procedural formats aimed at ensuring balanced forecasts. Bretschneider and Gorr (1987, 1992) investigate the effect of short-run political motives and procedural factors on forecast performance. Political factors and the implementation of good practices under economic uncertainty lead to an underestimation of revenues. They conclude that underestimation is welfare improving, as it provides a buffer stock of funds in the event of recession.

This conclusion is not supported by Mocan and Azad (1995), who study the revenue-forecasting performance of U.S. state legislative fiscal offices using panel data to estimate a random effects model of forecast errors. They find no relationship between political motives and forecast errors. Similarly, Cassidy, Kamlet, and Nagin (1989) reject a systematic relationship between forecast bias, and political and institutional factors. They note though that both positive and negative biases across time could have cancelled out. A paper by Rodgers and Joyce (1996) explores the occurrence of optimal, unbiased forecasts. The authors postulate that state forecasters do not choose rational “best estimates,” but instead make less risky downward-biased forecasts. They find that regardless of political, regional, procedural, or economic situations, state governments systematically bias forecasts downwards.

Apart from the studies on U.S. state governments, most other empirical work on revenue forecasting is country specific. Studies usually assess the accuracy of official forecasts and in most cases focus on industrial countries (e.g., Australia, Canada, Germany, the U.K., the Netherlands, and the U.S. federal government). A new cross-country data set on budget practices is currently being developed for OECD and emerging market economies.<sup>2</sup> The survey includes a section on revenue forecasting, but its coverage is very limited.

The more general theme of rationality in forecast errors primarily deals with the interference incentives of private forecasters. A paper by Laster, Bennett, and Geoum (1999) illustrates that professional private-sector forecasters behave strategically, and do not provide their true unbiased estimates. Similarly, Ehrbeck and Waldmann (1996) argue that forecasters tend to compromise between minimizing errors and mimicking prediction patterns typical of able forecasters. By doing so, they end up biasing their forecasts. Dopke (2000) argues that in Germany forecast errors made by publicly supported economic research institutes follow a political pattern. Finally, rational forecasting biases have been justified on the basis of asymmetric costs of forecast errors (Zellner, 1986), and this concept been repeatedly used in the forecasting literature (e.g., Ruge-Murciá, 2002; Christoffersen and Diebold, 2000).

The current paper goes beyond earlier empirical work by presenting new data on revenue forecasting in low-income countries. Forecasting interference is explained by government corruption and motivated by the well-established empirical fact of a high state capture in low-income countries (e.g., Treisman, 2000; Lienert and Sarraf, 2001). This new channel of facilitating corruption adds to the literature on extraction methods such as bribes or the manipulating of public policies (e.g., Bardhan, 1997; Hellman and Kaufmann, 2001). It also differs from previous explanations of revenue-forecasting interference in a corrupt environment (Danninger, 2004). Instead of arguing interference in revenue forecasts can reduce corruption by setting performance targets, the model presented here argues that interference has the opposite effect and conceals government corruption.

## **II. A NEW DATA SET ON REVENUE-FORECASTING PRACTICES**

### **A. Sample Characteristics**

Revenue-forecasting practices differ widely across countries, reflecting a mix of legacy systems, political constellations, and administrative needs. To capture these different aspects, a two-part questionnaire was sent to IMF fiscal economists assigned to area department country teams in early 2003, with a request to provide information on institutional arrangements and quantitative aspects of revenue forecasts. The first part of the questionnaire contains 36 questions on organizational and procedural characteristics; the second part requests data submissions on revenue forecasts and outturns.<sup>3</sup>

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<sup>2</sup> OECD and World Bank (2003).

<sup>3</sup> The institutional component of the questionnaire is divided into five sections covering (1) institutional arrangements between revenue administration and fiscal authority, (2) the macroeconomic forecast, (3) characterization of the revenue-forecasting process, (4) revenue-forecasting practices, and (5) data and

(continued...)

The survey covers 34 countries, 80 percent of which are low-income countries; the rest are transition economies, predominantly from the CIS. Roughly one-fourth of the countries are from sub-Saharan Africa; another 20 percent each are developing Asia and transition economies; the remaining countries are Middle Eastern and Western Hemisphere countries. The sample shows large differences in per capita income. The average income of the most advanced region is more than five times the income of the poorest region (Table 1). The level of country corruption in the sample is slightly higher than in a broader sample of countries.<sup>4</sup> Finally, slightly more than half of the countries in the sample were under an IMF program in 2003.

Table 1. Sample Characteristics

WEO Country classification	N	Percent	Average GDP per capita U.S.\$ (2000)
Sub-Saharan Africa	9	26.4	756
Developing Asia	7	20.6	731
Transition CIS including Mongolia	7	20.6	902
Middle East, Turkey	5	14.7	1809
Western Hemisphere	6	17.6	3975
Total	34	100.0	1504

Source: Authors's calculations.

## B. Description of Forecasting Practices

Table 2 summarizes key characteristics of forecasting practices.<sup>5</sup> In the vast majority of countries the ministry of finance (MOF) is the sole agency responsible for the budget. Responsibilities for the underlying macroeconomic forecasts are spread among government

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forecasting methods. Questions referred to current institutional conditions as observed during the last three years. The data request inquired about budget forecast and outcomes for various revenue and macroeconomic parameters. Survey design and related data issues are discussed in a separate note available upon request.

<sup>4</sup> The mean corruption perception index of countries in the sample is 1/7 standard deviations higher than the overall sample average from 183 countries. The corruption index is taken from Kaufmann, Kraay, and Mastruzzi (2003) and constructed as an inverted average over the last two available years of their control of corruption index. The control of corruption index measures the perception of corruption, defined as the exercise of public power for private gain. It is based on indicators from several sources using an unobserved-components methodology, which optimally weights each individual source according to its precision and reliability. Sources are large private enterprises, citizen and expert surveys, and nongovernmental institutions and international organizations.

<sup>5</sup> A complete description of all survey responses is discussed in a separate note and is available from the authors upon request.

agencies. In 44 percent of the countries one agency is solely responsible. Revenue forecasts are primarily one year ahead (64.7 percent); fewer than one-third of the sample countries

Table 2. Sample Revenue-Forecasting Characteristics

Variable description	Sample mean (%)	Significant regional variation /1	Significant variation by per capita
<b>General</b>			
One agency responsible for forecast	91.1	--	--
Macroeconomic forecast by one agency	44.1	--	--
Forecasting horizon limited to one year	64.7	--	--
Budget forecast covers only central government	47.0	--	--
Five or fewer staff in charge of forecast	23.5	--	--
<b>Methods</b>			
Basic extrapolations	83.9	--	--
Use of econometric methods	12.9	--	--
Use of disaggregate data	20.0	--	--
<b>Formality</b>			
Forecasting responsibilities formally defined	36.6	Yes 3/	--
Forecasting formally initiated	68.7	--	--
Formal revisions	64.7	Yes 3/	--
Formal documentation	51.6	--	--
<b>Organization</b>			
Forecasting produced by single agency	47.1	--	--
Only one uniform forecast produced	76.4	--	Positive
Macro forecast produced by single agency	44.1	--	--
<b>Transparency</b>			
Nongovernment agencies participate in forecast	34.4	--	Positive
Information published outside budget document	36.3	--	--
<b>Informational content in budget document</b>			
Aggregate revenue forecast	82.3	--	--
Breakdown of forecast into revenue types	85.3	--	--
Data on past revenue outturns	58.8	--	--
Analysis of past developments and forecasts	17.6	--	--
Summary of macro assumptions	55.9	--	--
Decomposition of forecast into various effects	20.6	--	--
<b>Interference</b>			
Significant discretionary adjustment of technical forecast	36.3	--	--

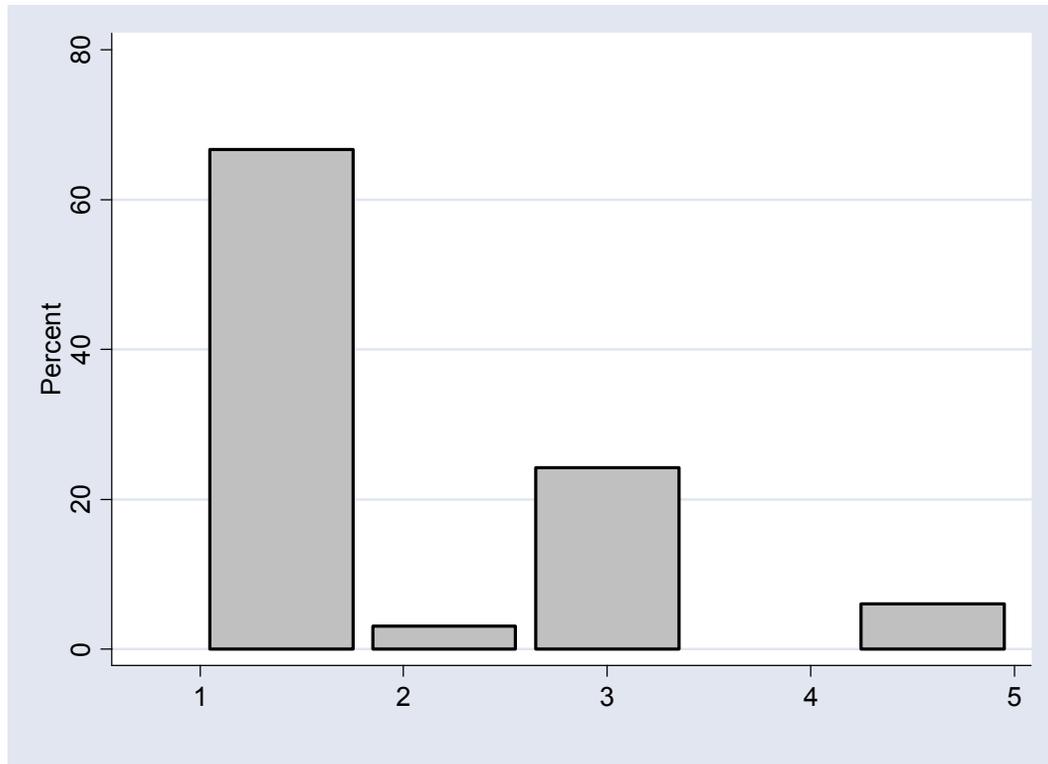
Source: Authors's calculations.

1/ F-test for group mean differences (10 percent significance).

2/ t-test for Spearman correlation coefficient.

3/ High scores in Western Hemisphere countries.

Figure 1. Forecasting Horizon of the Annual Budget Forecast  
(Percent of countries)



Source: IMF internal survey.

produce forecasts beyond one year (Figure 1). Budget coverage of government operations is mixed. Fewer than 50 percent of the countries forecast central government revenues only.<sup>6</sup> The prevailing estimation method is basic extrapolations combined with subjective assessments by technical experts (84 percent). The most common source of information is aggregate data—only 20 percent of the countries use disaggregated data as inputs. Human resources are fairly thinly spread. In 23 percent of the countries only five or fewer people are directly involved in the revenue forecast. There is little variation of these results across regions or per capita income level.

Three specific aspects of forecasting processes were examined in more detail, as they appeared particularly relevant for assessing forecasting timeliness and interference (See also Kyobe and Danninger, 2004). These three are (1) formality, (2) organizational simplicity, and

<sup>6</sup> Other areas of budget coverage are subnational governments (37 percent), non-social security funds (37 percent), public enterprises (20 percent), and social security funds (3 percent). Due to overlapping coverage, sample percentages add up to more than 50 percent.

<sup>8</sup> Details on the three indices are given in Appendix 1.

(3) transparency of the forecasting process. Survey responses along the above three dimensions were condensed into three index variables. A rationale for their use and definitions of the indices follow:<sup>8</sup>

**Formality.** Budget-preparation practices can range from the entirely unstructured to those regulated by a tight set of rules. The existence of formal rules on issues, such as forecasting responsibilities, calendar, and documentation, should be an indication of a well-structured process leading to more timely forecasts and reducing the scope for covert interference. The main drawback of this measure is that formality captures only explicitly formalized forecasting processes. The absence of written rules may not necessarily imply an arbitrary process and thus it may be too strict a criterion.<sup>9</sup> Formality for this analysis is defined as the unweighted sum of four binary variables: (1) whether forecasting responsibility is formally defined, (2) whether forecasting is formally initiated, (3) whether it is formally revised, and (4) whether it is formally documented.

**Organizational simplicity.** The number of involved agencies and competing internal forecasts should affect the quality and necessary time for producing a forecast. Countries may opt for a narrow group of forecasters producing one official forecast. Reliance on a small group of inside forecasters reduces resource and time costs; it may, however, also limit the quality of the forecasts and open the door to forecasting interference. Expanding the information basis most likely means the involvement of multiple agencies and/or the production of competing forecasts. Gains from broader participation may also come at the higher cost of coordination, which could undermine timeliness. Thus, there is no obvious premise for the effect of organizational simplicity. The index on simplicity is defined as the unweighted sum of three binary variables: (1) whether a single agency is responsible for the revenue forecast, (2) whether a single agency is responsible for the macroeconomic forecast, and (3) whether only one forecast produced.

**Transparency.** How much of the revenue forecast is open to the public depends on publication details and frequency, as well as whether nongovernment agencies can participate in the forecasting process. The amount of publicly available information has obvious implications for forecasting discipline, performance monitoring, and accountability. A high degree of transparency is likely to encourage an effective forecasting process and should limit the scope for interference. Transparency is defined as weighted sum of eight binary variables: (1) whether the macroeconomic assumptions are published outside budget, (2) whether outside agencies participate in revenue forecast, and (3)–(8) the amount of forecast-related information in the budget document.

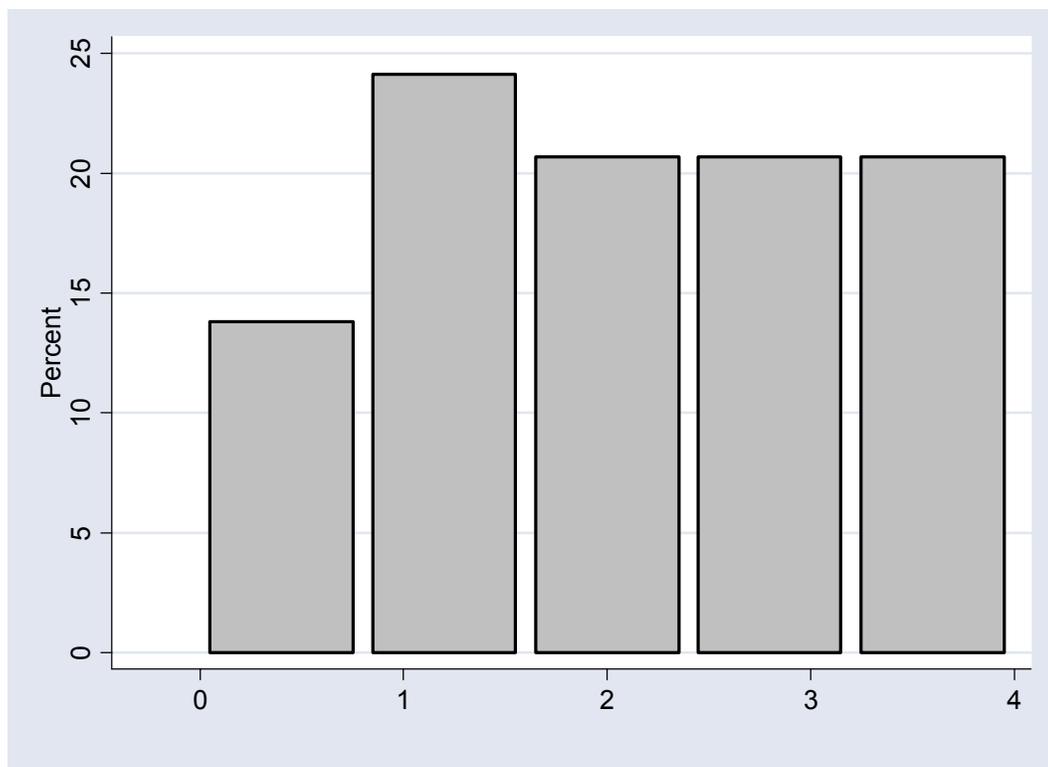
The scores of the three indices are positively correlated, with the correlation coefficient between transparency and formality being statistically significant. The main findings on the three characteristics are the following:

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<sup>9</sup> For example, the revenue-forecasting process in Germany follows a well-established routine without having a fixed set of rules governing the process.

Forecasting practices are not well rooted in formal rules, regardless of regions or per capita income level. The index of formality checks for the presence of basic forecasting regulations and sets a relatively low bar for defining formality (Figure 2). Only one fifth of the countries have formally defined responsibilities, and formally initiate, document, and revise their forecasts. About 13 percent of the sample countries have none of these characteristics, and almost 25 percent, only one formality aspect. Countries' scores do not vary statistically across regions or per capita income levels.<sup>10</sup>

Figure 2. Score on the Formality Indicator 1/  
(Sample distribution)



Source: IMF internal survey.

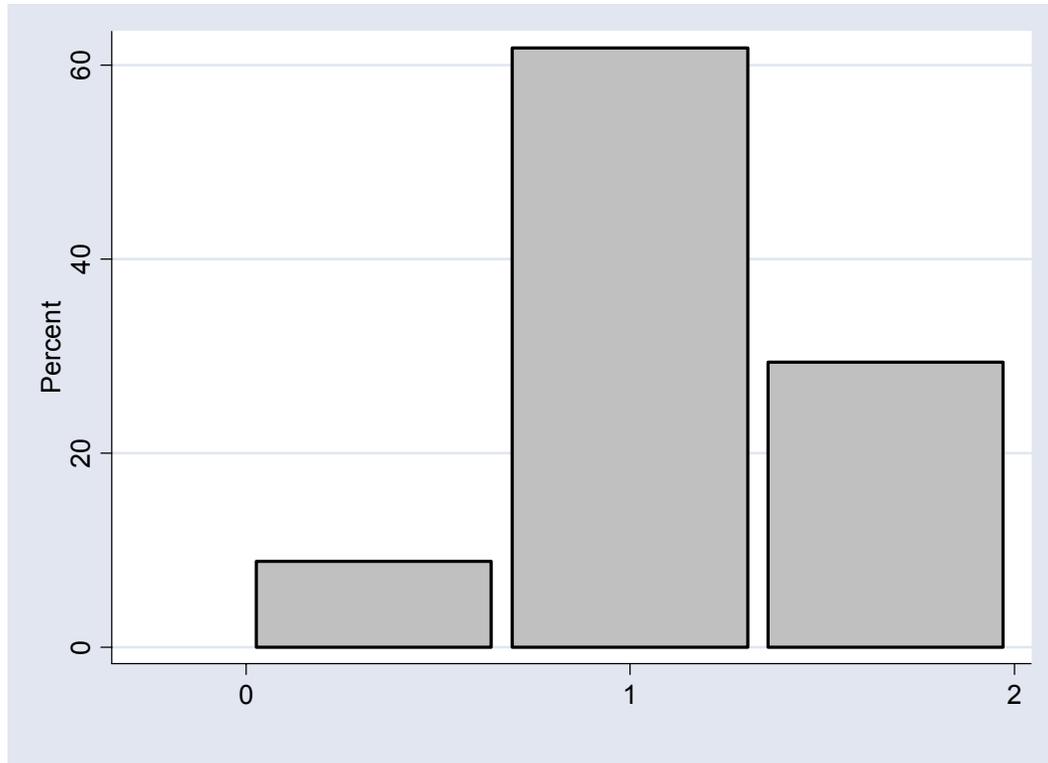
1/“Formality” is defined as the sum of four binary variables: (1) forecasting responsibility formally defined, (2) forecasting formally initiated, (3) forecasting formally revised, and (4) forecasting formally documented.

Forecasting processes tend to be organizationally complex and unrelated to a country's regional position or per capita income level. The index of simplicity presented in Figure 3 measures the number of agencies involved in the revenue and macroeconomic forecast, and the number of competing forecasts. The average score of the simplicity indicator is low, and

<sup>10</sup> Based on F-test for group mean differences and t-test for Spearman correlation coefficients.

none of the sampled countries receives the maximum score of three. About two-thirds of the sample countries meet only one characteristic and about 10 percent meet no simplicity aspect. Scores of the indicator do not differ significantly across regions or country income levels.<sup>10</sup>

Figure 3. Score on the Simplicity Indicator 1/  
(Sample distribution)

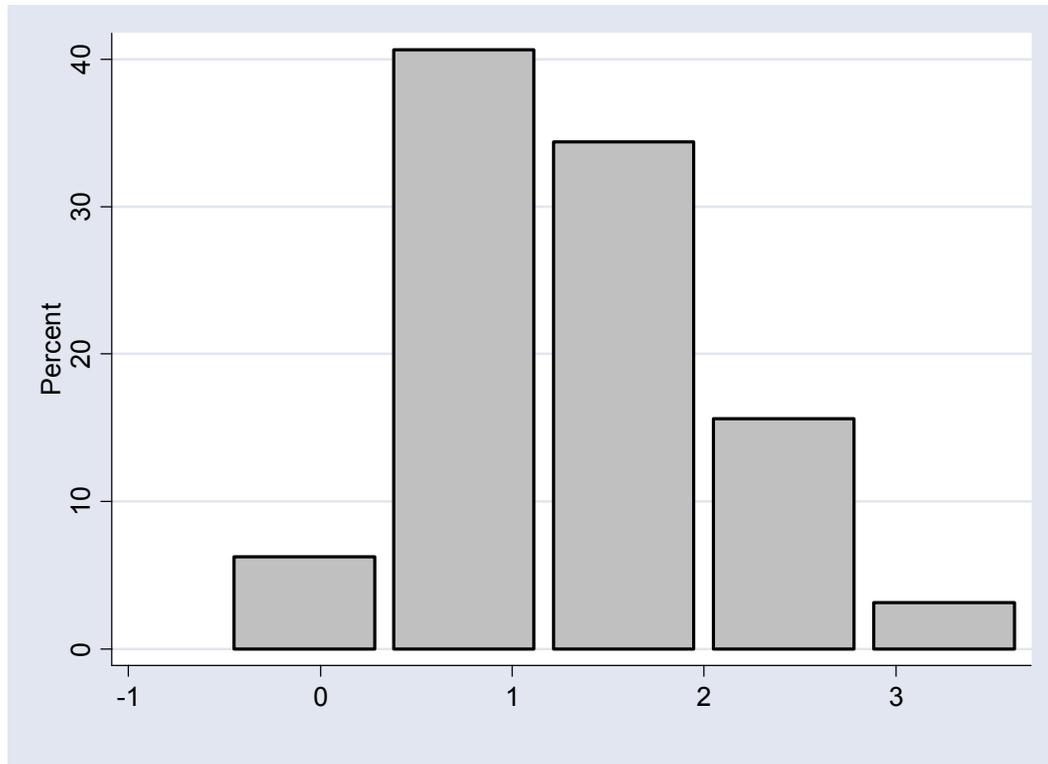


Source: IMF internal survey.

1/ Simplicity is defined as sum of binary variables: (1) single agency responsible for the revenue forecast, (2) single agency responsible for the macroeconomic forecast, and (3) one unified revenue forecast produced.

The transparency of revenue forecasts is relatively poor with some exceptions (Figure 4). Access to published information and the participation of outside government agencies in the process is relatively limited. In about two-thirds of the sampled countries, none or only one of the three transparency criteria are met. A small group of countries—primarily from Latin America—scores very high on the index reflecting a regional emphasis on good budget management practices (e.g., fiscal responsibility legislations). However, given the overall poor score on transparency in the sample, there appears sufficient room to allow covert interference in the forecast.

Figure 4. Score on the Transparency Indicator 1/  
(Sample distribution)



Source: IMF internal survey.

1/ Transparency is defined as weighted sum of eight binary variables: (1) whether the macroeconomic assumptions are published outside budget, (2) whether outside agencies participate in revenue forecast, and (3)-(8) different revenue forecast related information items in budget document.

### C. Forecasting Practices and Forecasting Timeliness

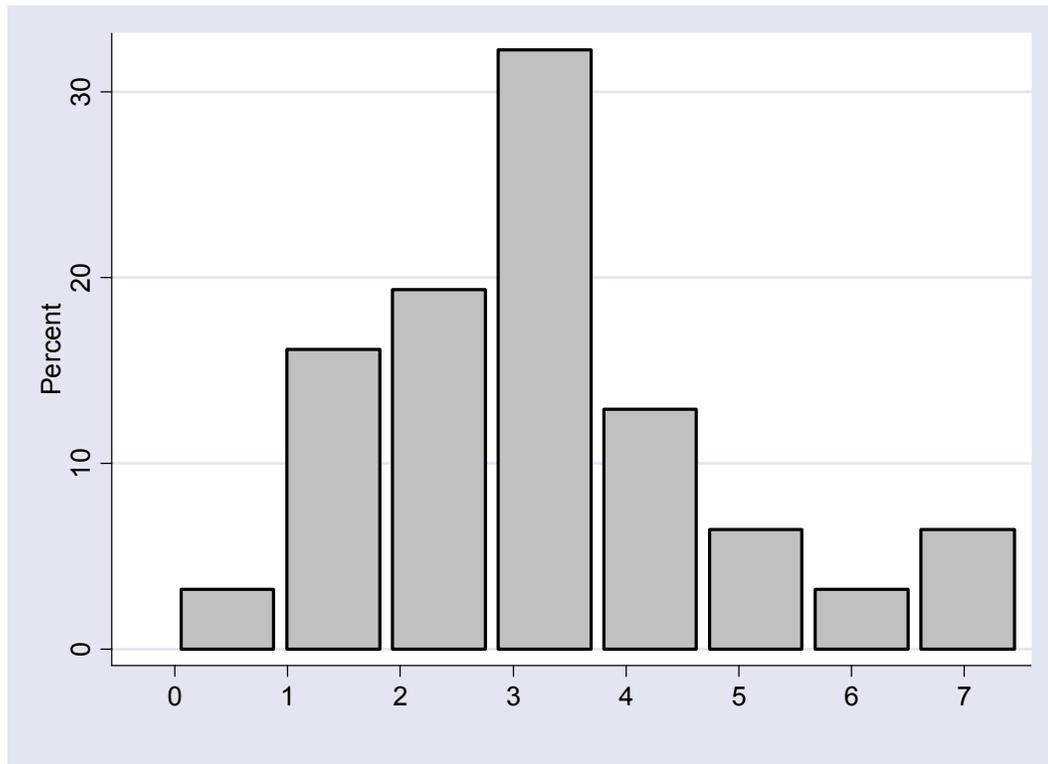
As revenue forecasts are a key input in defining the overall budget envelope, their production schedule is an important aspect of their effectiveness. Sufficient time needs to be allowed for the preparation of the expenditure plan so that spending agencies, such as line ministries, can prepare meaningful budgets. If resource constraints are not set early on, expenditure prioritization may not take place, and budget-balance targets may not be viewed as binding.

An empirical measure of revenue-forecasting efficiency is the number of months that the first draft revenue forecast is available prior to budget submission. In several OECD countries the budget circular is sent to the spending agencies at the beginning of the year, leaving nine to ten months for budget preparations. The drawback of an early revenue forecast is its proneness to error, as relevant new information is not incorporated. Often the budget circular addresses this uncertainty by requesting expenditure contingencies, which can be applied once a revised revenue forecast is available closer to the date of budget submission. A recent OECD study observes that countries with unstable and hard-to-forecast economic and fiscal

parameters generally need more time for budget preparation (OECD, 2001). A lead time of *six* months prior to budget preparation is generally seen as optimal to depoliticize the revenue-forecasting process. Most likely, revenue-forecasting processes with a shorter timeline do not give sufficient time for balanced discussions on spending priorities.

This prescription runs contrary to the actual practice observed in the data set. Figure 5 depicts the sample distribution of forecasting timeliness. About two-thirds of the countries prepare the *first* draft of the revenue forecast less than three months prior to budget submission. The late revenue-forecasting process sets a rather tight schedule and likely undermines the effort to include meaningful resource constraints in the budget planning process. Few countries allow sufficient time for budget preparation.

Figure 5. Timeliness of Revenue Forecast: Number of Months Forecast Available Before Budget Submission



Source: IMF internal survey.

Table 3 relates timeliness of the forecasts to several country characteristics and the three indicators of the revenue-forecasting process. The first three regressions test whether the three dimensions of forecasting practices matter individually. The fourth regression presents the combination of forecasting indices with the best fit, and the final regression tests whether the level of country corruption affects these results. The estimation method is ordinary least squares. A positive parameter means an earlier and thus timelier forecast in the budget preparation cycle.

Table 3. Revenue-Forecasting Efficiency and Forecasting Practices (OLS) 1/

	(1)	(2)	(3)	(4)	(5)
Timeliness of revenue forecast in months 2/					
Log (pop)	-0.328 (0.56)	0.080 (0.15)	-0.030 (0.05)	-0.245 (0.43)	-0.193 (0.32)
GDP/pop	-0.000 (1.56)	-0.000 (1.04)	-0.000 (0.71)	-0.000 (1.54)	-0.000 (1.53)
Transparency	0.768 (1.57)			0.671 (1.41)	0.575 (1.13)
Simplicity		1.033 (1.91)		0.945 (1.77)	0.969 (1.74)
Formality			0.218 (0.84)		
Corruption					-0.303 (0.25)
Constant	5.037 (1.22)	1.516 (0.39)	3.158 (0.75)	3.364 (0.83)	3.271 (0.79)
Observations	31	31	29	31	30
R-squared	0.11	0.15	0.04	0.21	0.24

Source: Authors's calculations.

1/ Absolute value of t statistics in parentheses.

2/ Dependent variable: months of revenue forecasts available prior to budget submission.

The main findings are that higher per capita income, process simplicity, and forecasting transparency improve forecast efficiency. The positive effect of per capita income can be explained by the more advanced public expenditure management practices in the relatively richer Latin American countries. Higher transparency, albeit only marginally significant, appears to have a disciplining effect on the production schedule, possibly through a publication commitment. The strong effect of simplicity suggests that a streamlined forecasting process is important. One explanation could be that streamlining eliminates coordination problems, which otherwise delay the forecasting timetable. Quite surprisingly, the formality of the forecasting process has no effect. Apparently, the fact that formal rules are adopted is not sufficient to move the forecasting process along. Finally, the level of perceived country corruption has no effect on the promptness of the forecast.

### **III. FORECASTING INTERFERENCE: THEORY AND EVIDENCE**

#### **A. Definition of Forecasting Interference**

Interference in the revenue-forecasting process can be either covert or explicit, may contain different implications for forecast errors, and may increase or decrease welfare. Therefore, in order to capture a broad range of practices, a definition of forecasting interference should go beyond specific statistical properties of the forecast error (e.g., biased forecasts), public observability (covert versus explicit interference), or specific welfare implications.

Forecasting interference in this paper is defined as a significant deviation between the budget forecast and a forecast by technical experts. This definition makes no assumption about forecast errors (e.g., biasing) and also does not prejudge welfare implications. It is sufficiently general to encompass a variety of reported practices. It captures explicit political manipulation of revenue forecasts in budget discussions; it includes explicit and publicly condoned modifications of underlying assumptions (e.g., conservative growth assumptions); it also incorporates the outright announcement of performance targets as forecasts.

One problem in identifying process-related interference is determining what constitutes a significant deviation from a technical forecast. Although any judgment on this issue involves some arbitrariness, a common understanding often exists among the parties involved in the forecasting process as to what justifiable forecasting assumptions and outcomes are. Such a consensus—and thus the absence of forecasting interference—can often be reached through discussions with the concerned experts. An occurrence of interference should therefore be identifiable with sufficient institutional knowledge.

#### **B. A Model of Government Corruption and Forecasting Interference**

Poor budget preparation and management practices are a well-documented fact for many low-income countries (Lienert and Sarraf, 2001; Abed and others, 1998). Weak institutions often go hand-in-hand with large resource losses attributed to corrupt bureaucracies (Friedman and others, 2000; Hellman and Kaufmann, 2001; and Fjeldstad and Tungodden, 2003). The proposed model presumes a weak institutional environment, and argues that interference in the revenue-forecasting process is another instrument to conceal the extraction of public resources. If the general public's access to information is sufficiently low, the government can hide the theft or mismanagement of revenue during the collection process by adjusting revenue forecasts. In a nutshell, corruption leads to interference in the revenue forecast.

One could ask why, assuming a corruption motive and low transparency, governments would engage in complex forecasting interference, instead of directly misusing expenditures. Two arguments can be put forward in favor of forecasting interference. First, interference in revenue forecasts is difficult to detect and thus involves less risk. Second, interference allows access to incoming resources, often in the form of cash, before it is recorded in government accounts. Such transactions are easier to manipulate and more difficult to trace.

The model assumes two agents, the government and the general public, with different degrees of information about a stochastic tax revenue  $T$ . Tax receipts can be either high or low, with probabilities  $p$  and  $(1-p)$ :

$$T(p) = \begin{cases} T_H & \text{with } p \\ T_L & \text{with } (1-p) \end{cases} \quad (1)$$

where  $T_H > T_L > 0$ . The public knows only the distribution of  $T(p)$ , while the government knows the realization of  $T$  ex ante. Revenue is the only input in the production of public services  $G$ , which are consumed by the general public. The level of  $G$  can assume two states depending on available budget allocations, which themselves depend on the revenue forecast  $\hat{T}$ . The budgeted  $G$  can then either be high or low:

$$G(T) = \begin{cases} G_H & \text{with } \hat{T}_H \\ G_L & \text{with } \hat{T}_L \end{cases} \quad (2)$$

When forecasting revenue, the government can be untruthful, or honest. If it is untruthful, it announces a low forecast when a high revenue outturn is expected ( $\hat{T}_L | T_H$ ), and keeps the residual  $\Delta T$  for own consumption:

$$\Delta T = T_H - T_L > 0 \quad (3)$$

If the government is truthful and revenue is high ( $\hat{T}_H | T_H$ ), then no state capture is received. If expected revenue is low, truthfulness is the dominant strategy ( $\hat{T}_L | T_L$ ), as forecast manipulation would automatically be detected. In the case of no directly detectable forecasting interference ( $\hat{T}_L | T_H$ ), the public can employ an audit strategy  $\alpha$ , which reveals cheating at a probability  $\alpha > 0$ . A successful audit allows the public to recoup lost revenue  $\Delta T$  at a linear cost  $C(\alpha) = \alpha$ . If cheating is unveiled, the government is penalized at a rate  $K > 0$ .

The government and the public maximize simultaneously individual utility from rent extraction and consumption. The government chooses a manipulation intensity  $0 \leq m \leq 1$ , and the public an audit intensity  $0 \leq \alpha \leq 1$ .

The government maximizes expected returns from forecast manipulation:

$$U(m) = p m \Delta T (1 - \alpha) - p m \alpha K \quad (4)$$

where  $m$  is defined as the probability that a manipulation takes place when a high tax revenue is expected. Governments can choose always to manipulate ( $m=1$ ), always be truthful ( $m=0$ ),

or cheat occasionally ( $0 < m < 1$ ). The choice of the optimal manipulation strategy  $m^*$  depends on the audit effectiveness, extraction gain, and the cost of being punished:

$$m^* = \begin{cases} 1 & \text{if } \alpha < \Delta T / (\Delta T + K) \\ (0,1) & \text{if } \alpha = \Delta T / (\Delta T + K) \\ 0 & \text{if } \alpha > \Delta T / (\Delta T + K) \end{cases} \quad (5)$$

Whether or not manipulation occurs depends on how high  $\alpha$  is, relative to the reward-penalty trade-off  $\Delta T/K$ . Large rewards from cheating  $\Delta T$  increase the threshold for manipulation; a high penalty  $K$  lowers it.

The public maximizes expected consumption of  $G$  by choosing an audit intensity  $\alpha$ . The public's utility function  $V(\cdot)$  is given by

$$V(\alpha) = pm(G_L + \alpha \Delta G) + (1-p)G_L - \alpha^2 \quad (6)$$

where  $\Delta G = G_H - G_L > 0$ . The first order condition with respect to  $\alpha$  is given by

$$\alpha^* = \frac{pm \Delta G}{2} \quad (7)$$

With a truthful government ( $m=0$ ),  $\alpha^*$  is always zero. The optimal audit intensity linearly increases in the recouped amount ( $\Delta G$ ), and also increases in the opportunity for cheating (high  $p$ ).

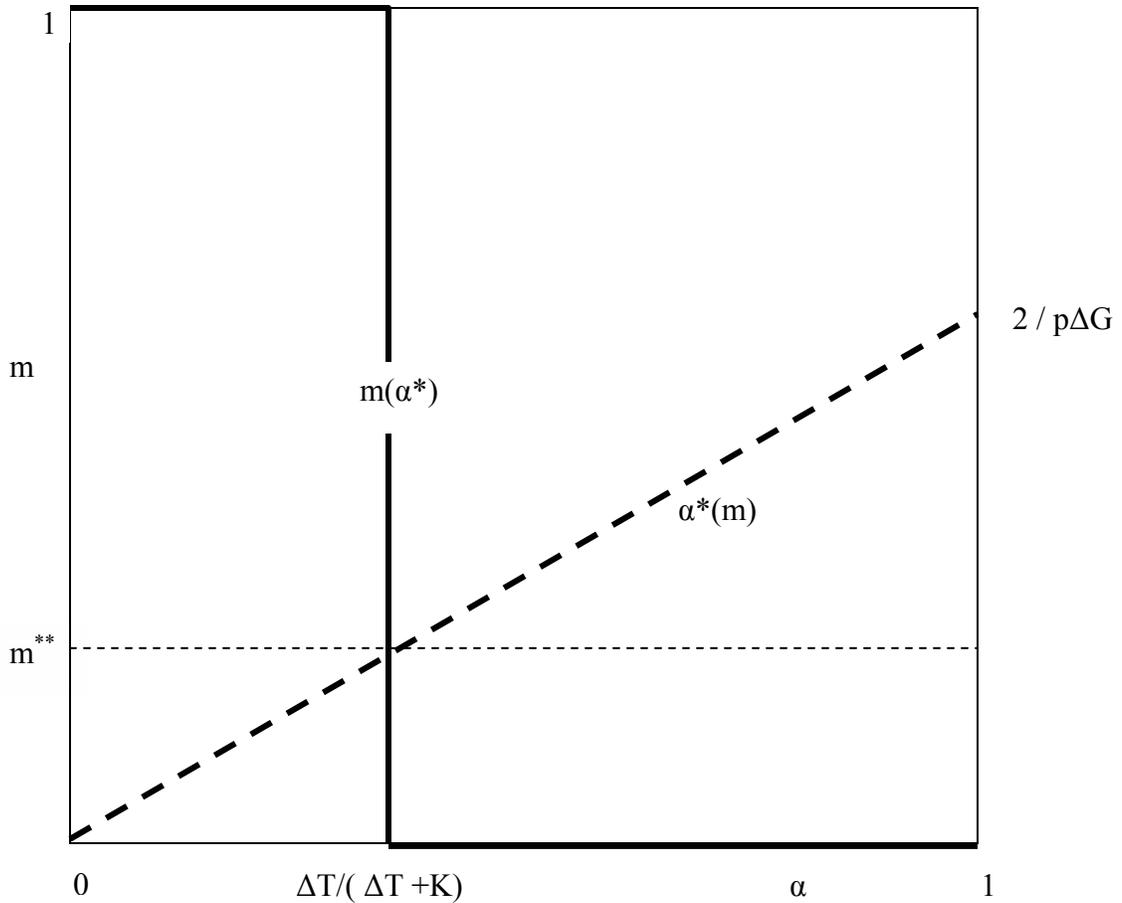
Conditions for an equilibrium of  $\alpha^{**}$  and  $m^{**}$  can be determined by solving the two first-order conditions represented by two reaction functions in Figure 6 (two bold lines). Both maximization conditions are satisfied where the two lines intersect.

$$\alpha^{**} = \Delta T / (\Delta T + K) \quad (8)$$

$$m^{**} = \frac{2\Delta T}{(\Delta T + K)\Delta G} \quad (9)$$

A mixed strategy Nash equilibrium with the depicted properties  $0 < m^{**} < 1$  and  $0 < \alpha^{**} < 1$  requires that  $\Delta G$  be sufficiently small, since otherwise incentives are too high for auditing and cheating becomes too costly. Under this condition, the government cheats occasionally, while the public chooses a selective audit strategy  $\alpha^{**} < 1$ . Because in equilibrium, corruption takes place with some positive probability, interference in the revenue forecast is clearly welfare deteriorating.

Figure 6. Equilibrium Manipulation and Audit Strategies



Source: IMF internal survey.

The proposed model is not the only conceivable explanation for forecasting interference. Danninger (2004) argues, for instance, that interference in the revenue forecast may be used to set performance targets for a corrupt revenue administration. Experiences in transition economies support this argument, and although the argument is also based on corruption, it concludes that interference is second-best welfare enhancing. Another argument for interference in revenue forecast can be derived from asymmetric costs of forecast errors. This argument assumes that revenue shortfalls relative to forecasts may be more costly to policymakers than revenue surpluses. In low-income countries, this may be the case when fiscal sustainability requires that budget targets are met to avoid negative market reactions, or a loss of support from international donors. Prudent forecasting in this model would be the natural consequence and welfare improving.

Interference in revenue forecasts can also be the result of expenditure pressures. If expenditure plans are inconsistent with the resource constraint, governments may be forced to make “revenue concessions,” so as not to violate a budget-balance target. Interference

would result in revenue underperformance and a deficit bias. A prudent ministry of finance may, however, anticipate last-minute pressure, and build a reserve into its revenue forecasts. This type of ex ante interference would allow the accommodation of the spending request without biasing the forecast or violating a deficit target.

### **C. Empirical Analysis of Forecasting Interference**

The questionnaire measures the incidence of forecasting interference by drawing on IMF institutional knowledge. A questionnaire asked IMF fiscal economists to characterize the current forecasting practice in various countries and assess whether technical forecasts prevail or whether significant discretionary adjustments occur. This section analyzes the survey responses and examines whether the incidence of interference is related to corruption. It also assesses the role of the three forecasting process characteristics— formality, simplicity, and transparency—discussed in the previous section.

As shown in Table 2, interference in the forecasting process is widespread and occurs regularly in 36 percent of the sampled countries. The incidence of interference is statistically unrelated to the level of income or regional groupings. As a consistency check, a preliminary analysis tested whether forecasting interference is correlated with forecast errors. No statistical correlation between percent forecast errors and forecasting interference could be established. This finding is, however, only tentative, as the empirical analysis was marred by data problems.<sup>11</sup>

#### **Interference and corruption**

To investigate whether interference is related to poor public governance, we relate the survey measure of interference to various country characteristics, including the level of country corruption. Table 4 presents the results from three specifications and shows that country corruption is a robust predictor of forecasting interference. The first logit model uses standard country controls. In model two the specification is extended to include regional dummy variables. Model three addresses the possibility of endogeneity between forecasting interference and country corruption, and applies an instrumental variable estimator for probits.<sup>12</sup> Here also, corruption remains a strong predictor for forecasting interference.

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<sup>11</sup> Data on revenue forecasts and outcomes were collected for the last five years. Submissions were however in many cases incomplete and error ridden. About 30 percent of the countries reported none or incomplete data, and about half of the countries had observations with excessively high forecast errors (exceeding 50 percent of actual outcomes). To augment the data set, we supplied missing data on GDP forecast or revenue outturns from past IMF staff reports. Observations with errors in excess of 50 percent were dropped from the sample. We then regressed percentage tax revenue forecast errors on percentage nominal GDP forecast errors and other control variables (per capita GDP, population size, reliance on natural resources, and data imputation and regional dummies). GDP forecast errors were positively correlated with revenue forecast and decline with the level of per capita income. The incidence of forecast interference had no significant effect when added to this specification.

<sup>12</sup> Amemiya Generalized Least Squares (AGLS) estimators for probits with endogenous regressors.

Table 4. Discretionary Interference and Country Corruption 1/

	(1)	(2)	(3)
	OLS	OLS	IV 2/
Log (pop)	-0.677 (0.93)	-1.758 (1.46)	-0.692 (1.25)
GDP per capita	0.000 (0.65)	0.001 (1.28)	0.000 (1.44)
Corruption	2.965 (1.85)	3.722 (1.69)	3.534 (2.30)*
Constant	2.490 (0.49)	10.013 (1.33)	2.244 (0.60)
Reg. dummy	No	Yes	No
Observations	32	32	32

Source: Authors' s calculations.

1/ Dependent variable: incidence of interference in revenue forecast. Absolute value of z statistics in parentheses.

2/ Implement Amemiya Generalized Least Squares (AGLS) estimators for probit. Instruments: indicators of political stability, civil rights, rule of law, government efficiency.

\* Significant at 5 percent; \*\* Significant at 1 percent.

The finding on corruption is robust to alternative specifications related to competing interference motives, namely forecast as performance targets, fiscal sustainability concerns, and expenditure demand pressures. Danninger (2004) argued that corruption in an unmonitored revenue administration may lead to interference in order to turn forecasts into performance targets. A corollary of this argument is that countries with an independent or autonomous revenue administration may be more likely to have a higher incidence of forecasting interference. This argument is tested by adding two variables to the basic model, an indicator measuring whether the revenue administration is part of the ministry of finance, and an indicator for the degree of decision-making autonomy by the revenue administration.<sup>13</sup>

Table 5 presents the results from logit and instrumental variable probits . The main finding is that the autonomy of the revenue administration does not appear to play a role in determining interference. The first two models test for the independence of the revenue administration. At a first look, the independence of the revenue administration seems to increase the likelihood of interference (model one). This effect is, however, specific to transition economies, and vanishes in the instrumental variable model. Models three and four examine the effects of the

<sup>13</sup> The indicator is derived from questions on the relationship between the revenue administration and the main fiscal agency. The degree of autonomy measures whether the revenue administration (1) can set its salary scale, (2) can make firing and hiring decisions, and (3) has own resources to finance day-to-day operations.

administrative autonomy of the revenue administration. In neither of the two specifications does autonomy play a role. Finally, we also included interaction effects between administrative autonomy and corruption and could not detect statistically significant parameters (not shown).

Table 5. Discretionary Interference and Independence of Revenue Authority (RA) 1/

	(1) Logit	(2) Probit-IV	(3) Logit	(4) Probit-IV
Log (pop)	-0.743 (0.96)	-0.888 (1.25)	-0.603 (0.79)	-0.894 (1.28)
GDP per capita	-0.000 (0.15)	0.000 (0.86)	0.000 (0.68)	0.001 (1.55)
Corruption	1.987 (1.17)	3.403 (1.59)	3.006 (1.64)	5.066 (2.04)
RA part of MOF	-1.860 (1.74)	-0.808 (0.90)		
RA autonomy			-0.194 (0.45)	-0.520 (1.18)
Constant	5.182 (0.90)	4.375 (0.89)	2.148 (0.40)	3.338 (0.72)
Observations	32	32	30	30

Source: Authors's calculations.

1/ Dependent variable: incidence of interference in revenue forecast. Absolute value of z statistics in parentheses.

For low-income countries, fiscal sustainability concerns may be an alternative explanation for interference. A cautious approach to forecasting could be explained by the asymmetric costs of forecast errors. Countries with an urgent need to meet fiscal targets may put greater weight on prudent forecasts. To gauge this effect, two variables were added to the basic interference model in Table 6. One is the share of interest payments in government expenditures, which is more readily available than debt stock data. The other is the degree of IMF involvement during the last five years as a proxy for the degree of dependence on external assistance. Both variables are not significant and the results on corruption hold up in the model.

Table 6. Discretionary Interference, Fiscal Sustainability, and Expenditure Pressure 1/

	(1) Logit	(2) Probit-IV	(3) Logit	(4) Probit-IV	(5) Logit	(6) Probit-IV
Log (pop)	-0.607 (0.81)	-0.644 (1.13)	-0.412 (0.52)	-0.538 (0.88)	-1.032 (1.20)	-0.981 (1.41)
GDP per capita	0.000 (0.69)	0.000 (1.42)	0.000 (0.56)	0.000 (1.31)	-0.000 (0.09)	0.000 (0.84)
Corruption	2.876 (1.79)	3.445 (2.24)*	2.771 (1.73)	3.410 (2.19)*	2.331 (1.24)	3.577 (1.79)
Interest/total expenditure	-0.022 (0.46)	-0.010 (0.28)				
IMF-5 2/			1.223 (0.95)	0.617 (0.68)		
Expenditure pressure					2.466 (1.85)	1.403 (1.25)
Constant	2.307 (0.45)	2.080 (0.55)	-0.214 (0.04)	0.761 (0.17)	5.108 (0.85)	4.105 (0.86)
Observations	32	32	32	32	30	30

Source: Authors's calculations.

1/ Dependent variable: incidence of interference in revenue forecast. Absolute value of z statistics in parentheses.

2/ Fraction of years under IMF supported program during the last five years.

\* Significant at 5 percent; \*\* Significant at 1 percent.

Table 6 also tests whether revenue forecasts are adjusted to accommodate incompatible expenditure plans. If spending ministries or parliament are politically powerful vis-à-vis the finance ministry, then adjusting revenue forecasts could be one strategy to meet both fiscal balance targets and expenditure needs. A prudent finance ministry may even anticipate this pressure and produce a conservative revenue forecast ex ante to ensure a margin for adjustment. This type of interference was directly addressed in the questionnaire. IMF fiscal economists had to report whether revenue forecasts were adjusted when they were incompatible with expenditure plans. Models five and six include this variable. In the logit model, expenditure pressure has a positive and significant effect, giving support to the expenditure-pressure motive, while the corruption effects remain strong. In the instrumental variable model the corruption effects remains dominant.

Finally, the basic specification was extended to test whether different forecasting practices affect forecasting interference. The three indices for formality, simplicity, and transparency were added to the model. Since nonlinear effects of the indicators are conceivable (i.e., threshold levels), quadratic, exponential, and logarithmic transformations of the indices were tested. Table 7 summarizes the basic findings and reports the results on transformed variables only when the alternative specifications were significant. Models one and two show that organizational simplicity bears no relationship to forecasting interference and the finding on

corruption remains intact. Formality (models three and four) has a negative sign and reduces interference, but the estimated parameter is not significant. However, introducing formality weakens the corruption effect and renders it insignificant. The final two models present the result from quadratic specifications on the transparency indicator, which are borderline significant. The sign on the estimated parameters predicts an inverse u-shaped effect with a turning point estimated at a transparency score of 1.29 in model five and 1.33 in model six.<sup>14</sup> About 52 percent of the countries exceed this level and thus are affected by the negative effect of transparency on interference. Nonetheless, transparency does not wipe out the corruption effect.

Table 7. Discretionary Interference and Forecasting Practices

	(1) Logit	(2) Probit-IV	(3) Logit	(4) Probit-IV	(5) Logit	(6) Probit-IV
Log (pop)	-0.712 (0.97)	-0.697 (1.26)	-0.151 (0.18)	-0.514 (0.65)	-0.777 (0.90)	-1.081 (1.25)
GDP per capita	0.000 (0.74)	0.000 (1.48)	-0.002 (1.30)	-0.000 (0.13)	0.000 (1.02)	0.000 (1.55)
Corruption	3.178 (1.96)	3.741 (2.32)*	1.452 (0.73)	3.500 (1.54)	3.408 (1.82)	4.853 (2.13)*
Simplicity	0.431 (0.59)	0.533 (0.91)				
Formality			-0.172 (0.51)	-0.115 (0.37)		
Transparency					6.348 (1.67)	4.125 (1.33)
Transparent ^2					-2.449 (1.51)	-1.546 (1.20)
Constant	2.063 (0.40)	1.490 (0.39)	1.187 (0.20)	1.443 (0.26)	-0.325 (0.06)	1.978 (0.37)
Observations	32	32	28	28	31	31

Source: Authors' calculations.

1/ Dependent variable: incidence of interference in revenue forecast. Absolute value of  $z$  statistics in parentheses.

\* Significant at 5 percent; \*\* Significant at 1 percent.

<sup>14</sup> The turning point for the transparency effect is calculated as  $-a/2b$ , where  $a$  is the parameter estimate on the transparency variable and  $b$  the estimate on the squared transparency variable.

#### IV. CONCLUSIONS

Revenue forecasting in low-income countries is a vastly under researched topic. Despite its strategic role in the budget preparation process, little is known about forecasting practices, the efficiency of the forecasting process, and the rationale for forecasting interference. This paper presents results from a new data set on revenue-forecasting practices. It provides a first systematic and comprehensive glimpse at institutional arrangements on a cross-country basis. However, given the small sample size and the reliance on expert information, the findings should be interpreted with caution.

A few conclusions can be drawn from the empirical analysis of the data set. First, forecasting procedures are poor in many countries. Relatively complex and intransparent processes seem to hamper timely revenue forecasts, which are essential for an effective budget formulation process. While formal rules are generally considered important, they do not appear to improve forecasting timeliness.

Tentative lessons can also be drawn from the analysis of forecasting interference. Contrary to the argument of a beneficial bias—as exemplified by cautious forecasts—the empirical results suggest that governance problems are the main reason for forecasting interference in low-income countries. The explanation put forward in this paper is that interference conceals the illegal withholding of funds during the revenue collection process. Among other explanations for interference, expenditure pressures in the budget preparation process also seem to play a role.

Forecasting practices matter only to a limited extent in reducing forecasting interference. A more formal or less complex process is not sufficient to reduce interference. Only forecasting transparency reduces it. Based on this finding, information access and greater participation of nongovernment institutions in the revenue-forecasting process should receive heightened attention by policy makers and advisors.

## **Indices of Forecasting Practices**

This appendix discusses the definition and sample characteristics of three indices: (1) formality, (2) simplicity, and (3) transparency of the forecasting process. Table A1 below reports summary statistics for the individual indices.

### **Index of formality**

Formality is defined as the unweighted sum of four binary variables: (1) whether forecasting responsibility is formally defined by rules, (2) whether forecasting is formally initiated, (3) whether it is formally revised, and (4) whether it is formally documented. The index is linear additive and scores can range between 0 and 4.

Average sample responses are summarized in Table 2 below. A formal definition of responsibilities exists only in 36 percent of the countries. About two-thirds of the countries formally initiate the annual budget revenue-forecasting exercises (e.g., through circular). In only half of the countries is the forecasting process formally documented. And within-year revisions of the revenue forecast (64 percent) are mostly carried out on an “as needed” basis (50 percent). Only about half of the countries revise the budget forecast (one year ahead) in the course of the budget preparation.

### **Index on organizational simplicity**

The index on simplicity is defined as the unweighted sum of three binary variables: (1) whether a single agency is responsible for the revenue forecast, (2) whether a single agency is responsible for the macroeconomic forecast, and (3) whether only one forecast produced. The index is linear additive and scores can range between 0 and 3.

Sample responses of the three components indicate that roughly half (47.1 percent) of the countries put only one government agency in charge of the revenue forecast. This figure is slightly smaller for the macroeconomic forecast (44.1 percent). In most cases (76.5 percent), the government only produces one forecast and thus forgoes the option of competing forecasts.

### **Transparency index of the forecasting process**

Transparency defined as weighted sum of eight binary variables: (1) whether the macroeconomic assumptions are published outside budget, (2) whether outside agencies participate in revenue forecast, and (3)–(8) different revenue forecast related information were published in the budget document. Items (3)–(8) were given weights of one sixth to give the aggregate information content in the budget document the same weight as the information items (1) and (2).

Table 8. Summary Statistics of Indices on Forecasting Practices

Index	Sample mean (%)	Median	Std. Dev	Significant regional variation 1/	Significant variation by per capita income 2/
Formality	2.10	2.00	1.37	--	--
Simplicity	1.21	1.00	0.59	--	--
Transparency	1.21	1.25	0.75	Yes	Positive

Source: Authors' s calculations.

1/ F-test for group mean differences (10 percent significance).

2/ T-test for Spearman correlation coefficient.

## REFERENCES

- Abed, George T., and others, 1998, *Fiscal Reforms in Low-Income Countries: Experience Under IMF-Supported Programs*, IMF Occasional Paper No. 160 (Washington: International Monetary Fund).
- Allen, Richard, and Daniel Tommasi, eds., 2001, *Managing Public Expenditure* (Paris: Organization for Economic Co-operation and Development).
- Alt, Robert, 1993, "Revenue Forecasting and Estimation—How It's Done, State-By-State," *State Tax Notes*, Vol. 4 (May), pp. 1038–51.
- Auerbach, Alan J., 1999, "On the Performance and Use of Government Revenue Forecasts," *National Tax Journal*, Vol. 52 (December), pp. 767–82.
- Bardhan, Pranab, 1997, "Corruption and Development: A Review of Issues," *Journal of Economic Literature*, Vol. 35 (September), pp. 1320–46.
- Bretschneider, Stuart I., and Wilpen Gorr, 1992, "Economic, Organizational, and Political Influences on Biases in Forecasting State Sales Tax Receipts," *International Journal of Forecasting*, Vol. 7, No. 4, pp. 457–66.
- , 1987, "State and Local Government Revenue Forecasting," in *The Handbook of Forecasting*, ed. by Spyros Makridakis and Steven C. Wheelwright (New York: Wiley, Second Edition).
- Cassidy, Glenn, Mark S. Kamlet, and Daniel S. Nagin, 1989, "An Empirical Examination of Bias in Revenue Forecasts by State Governments," *International Journal of Forecasting*, Vol. 5, No. 3, pp. 321–31.
- Christoffersen, Peter F., and Francis X. Diebold, 1997, "Optimal Prediction Under Asymmetric Loss," in *NBER Econometric Theory*, Research Paper No. 167 (December), pp. 1–36 (Cambridge, Massachusetts: National Bureau of Economic Research).
- Danninger, Stephan, 2005, "Revenue Forecasts as Performance Targets," IMF Working Paper (Washington: International Monetary Fund, forthcoming).
- Döpke, Jörg, 2000, "Haben Konjunkturprognosen in Deutschland einen politischen Bias?" *Journal of Applied Social Science Studies*, Vol. 120, No. 4, pp. 587–620.
- Ehrbeck, Tilman, and Robert Waldmann, 1996, "Why Are Professional Forecasters Biased? Agency Versus Behavioral Explanations," *The Quarterly Journal of Economics*, Vol. 111 (February), pp. 21–40.

- Fjeldstad, Odd-Helge, and Bertil Tungodden, 2003, "Fiscal Corruption: A Vice or Virtue?" *World Development*, Vol. 31, No. 8, pp. 1459–67.
- Friedman, Eric, and others, 2000, "Dodging the Grabbing Hand: The Determinants of Unofficial Activity in 69 Countries," *Journal of Public Economics*, Vol. 76 (June), pp. 459–93.
- Golosov, Mikhail, and John King, 2002, "Tax Revenue Forecasts in IMF-Supported Programs," IMF Working Paper 02/236 (Washington: International Monetary Fund)
- Harvey, David, Stephen Leybourne, and Paul Newbold, 1997, "Testing the Equality of Prediction Mean Squared Errors," *International Journal of Forecasting*, Vol. 13 (June), pp. 281–91.
- Hellman, Joel, and Daniel Kaufmann, 2001, "Confronting the Challenge of State Capture in Transition Economies," *Finance & Development*, Vol. 38 (September), pp. 31–35.
- Jacob, Brian A., and Steven D. Levitt, 2003, "Rotten Apples: An Investigation of the Prevalence and Predictors of Teacher Cheating," *The Quarterly Journal of Economics*, Vol. 118, No. 3, pp. 843–77.
- Kaufmann, Daniel, Aart Kraay, and Massimo Mastruzzi, 2003, "Governance Matters III, Governance Indicators for 1996–2002," (Washington: World Bank).
- Kyobe, Annette, and Stephan Danninger, 2005, "Revenue Forecasting: How Is It Done? Experiences from Low-Income Countries," IMF Working Paper (Washington: International Monetary Fund, forthcoming).
- Laster, David, Paul Bennett, and In Sun Geoum, 1999, "Rational Bias in Macroeconomic Forecasts," *The Quarterly Journal of Economics*, Vol. 114 (February), pp. 293–318.
- Lienert, Ian C., and Feridoun Sarraf, 2001, "Systemic Weaknesses of Budget Management in Anglophone Africa," IMF Working Paper 01/211 (Washington: International Monetary Fund).
- Mocan, H. Nael, and Sam Azad, 1995, "Accuracy and Rationality of State General Fund Revenue Forecasts: Evidence from Panel Data," *International Journal of Forecasting*, Vol. 11 (September), pp. 417–27.
- Organisation for Economic Co-operation and Development and World Bank, 2003, "OECD/WB Budget Practices and Procedures Survey," Public Governance and Territorial Development Directorate (Paris: Organization for Economic Co-operation and Development).

Rodgers, Robert, and Phillip Joyce, 1996, "The Effect of Underforecasting on the Accuracy of Revenue Forecasts by State Governments," *Public Administration Review*, Vol. 56 (January–February), pp. 48–56.

Ruge-Murciá, Francisco J., 2002, "A Prudent Central Banker," *Staff Papers*, International Monetary Fund, Vol. 49, No. 3, pp. 456–69.

Tanzi, Vito, and Hamid Davoodi, 2000, "Corruption, Growth, and Public Finances," IMF Working Paper 00/182 (Washington: International Monetary Fund).

Treisman, Daniel, 2000, "The Causes of Corruption: A Cross-National Study," *Journal of Public Economics*, Vol. 76 (June), pp. 399–458.

Zellner, Arnold, 1986, "Biased Predictors, Rationality and the Evaluation of Forecasts," *Economics Letters*, Vol. 21, No. 1, pp. 45–48.