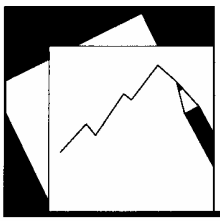
WP/05/14



IMF Working Paper

Revenue Forecasts as Performance Targets

Stephan Danninger

INTERNATIONAL MONETARY FUND

 WP/05/14

IMF Working Paper

Fiscal Affairs Department

Revenue Forecasts as Performance Targets

Prepared by Stephan Danninger[1]

Authorized for distribution by Manmohan Kumar

January 2005

Abstract

Budget revenue forecasts should be best estimates of expected receipts. Often they are not. This paper analyzes the rationale for overstated revenue forecasts and derives conditions for intentional biases. A theoretical model demonstrates that overstated revenue forecasts can be the result of the government's attempt to boost unobserved revenue collection effort. If positive forecast errors are costly and undermine public credibility of budget expenditure plans, the reverse outcome is possible and governments may understate revenue forecasts. A case study for Azerbaijan is presented in support of the former incentive motive.

JEL Classification Numbers: H2

Keywords: Revenue forecast

Author(s) E-Mail Address: sdanninger@imf.org

[1] Presented at the Sixth international conference on "Institutions in Transition," September 2002, Ljubljana, Slovenia. I would like to thank John Wakeman-Linn, Marco Cangiano, and G.A. Mackenzie for their useful comments.

Contents

INTRODUCTION

Accurate revenue forecasts are widely regarded as a key element for the design and execution of sound fiscal policies. Large forecast errors can lead to significant budget management problems, such as expenditure arrears and a stop-and-go expenditure policy, and pose an important obstacle to the development of a meaningful medium-term budget plan. Moreover, unrealistic budget plans are inconsistent with basic principles of transparency and diminish public accountability of fiscal operations.

While forecast errors can never be entirely avoided, in several developing countries budget revenue estimates have systematically deviated from actual revenue receipts. During 1985–95, tax revenue forecasts were above outturns 77 percent of the time in a sample of 34 low-income developing countries (Abed, 1998). This pattern has been frequently attributed to the influence of political factors on revenue forecasts. In a recent study, Lienert and Sarraf (2001) argue that underdeveloped institutional capacities are one likely reason for intentionally overstated forecasts in developing countries.

A common explanation for biased forecasts in the literature is asymmetric costs of forecast errors (Zellner, 1986). Examples are conservative budget forecasts in Canada and the Netherlands during the 1990s, which were explicitly prudent to reduce the possibility of politically costly revenue shortfalls. Two factors make this an unlikely explanation for low-income countries. First, asymmetric costs would most likely lead to downward biased forecasts and thus are inconsistent with the empirical evidence. Second, explicit biasing requires a forward looking budget preparation process based on efficient budget planning tools. Both conditions are often not met in low-income countries, as they lack institutional rigor and have limited human resources. A more plausible explanation should instead focus on the role of underdeveloped institutions for the forecasting process.

This paper presents a new explanation for rationally biased budget revenue forecasts based on institutional weaknesses, and provides supportive case study evidence from Azerbaijan. The paper argues that upward biased forecasts are the result of a government's inability to monitor the performance of its tax administration. If a government cannot directly control its efforts in its tax administration, it may use revenue forecasting as an incentive device. By overstating forecasts, a government can create performance pressure in the revenue administration as long as revenue collection shortfalls relative to the forecasts are costly to the revenue administration. Descriptive evidence from recent budget revenue forecasts in Azerbaijan is presented to support this explanation.

The model is premised on a classic principal-agent setup: the main fiscal authority (e.g., the ministry of finance) as the principal, provides public services under conditions of imperfect control over its agent, the revenue administration. The agent chooses the level of unobservable effort and thereby determines the revenue available for the government to fulfill its functions. The efficiency of government services is under public scrutiny. Since the public is critical of low performance, it dislikes large revenue shortfalls relative to budget estimates and exerts pressure to penalize responsible officials. Thus, the revenue

administration has an incentive to not deviate too much from the official revenue forecast. This allows the fiscal authority to use overstated forecasts as an incentive device to increase performance efficiency at the cost of producing unrealistic forecasts. As long as the gains from increasing effort outweigh the costs of producing ex post forecast errors, the government will produce overstated revenue forecasts.

The recent forecasting experience in Azerbaijan and its institutional arrangements make it a suitable case study. The ministry of taxes in Azerbaijan is an independent government body and is locally, as well as administratively, separated from the ministry of finance. In the past, revenue collected by the ministry of taxes has regularly fallen short of budget forecasts. On average, state budget revenue outturns were 7 percent below forecasts during the last five years. A number of alternative hypotheses are discussed, but appear implausible, so that intentional overstating of forecasts cannot be ruled out as an explanation.

The remainder of this paper is structured as follows. Section II reviews related literature. Section III summarizes the main assumptions and results of the proposed explanation for biased forecasts. This analysis is based on a theoretical model developed in detail in the appendix. Section IV discusses case study evidence from Azerbaijan. It highlights institutional arrangements between the ministry of finance and the tax administration, analyzes the revenue forecasting practice, and presents descriptive evidence of an upward forecasting bias. The final section concludes.

I. Related Literature

While the existing literature recognizes the importance of accurate forecasting, most research focuses on budget revenue forecasts in industrial countries.[2] A number of studies examine the performance of revenue forecasts in individual countries, but they almost exclusively focus on technical aspects of the forecast (Auerbach, 1999, for the United States; Dopke, 2000, for Germany; Pike and Savage, 1998, for the United Kingdom; and Shroeder and Wasylenko, 1989, for Thailand).

The only comparative studies analyzing determinants of forecast errors are available for the U.S. state governments. The findings on biasedness of forecasts and the role of political influence are mixed.[3] Bretschneider and Gorr (1989 and 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 revenue forecasting performance of U.S. state legislative fiscal

[2] In 2002, *IMF Staff Papers* dedicated part of Volume 48 to forecasting. See, Musso and Philips, 2002.

[3] For an overview of forecasting practices in the U.S. states, see Alt, 1993.

offices using panel data to estimate 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 however, that both positive and negative biases across time, could have cancelled out. A paper by Rodgers and Phillips (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 forecast downwards.

The ambiguous results from the U.S. studies are contrary to a widespread belief that in low-income countries political influence does affect revenue forecasts. Lienert and Sarraf (2001) highlight the prevalence of systematic revenue forecast errors in developing countries and attribute them in part to institutional weaknesses. Revenue overestimation in transition countries may also be tied to political factors in combination with a delayed budget preparation process (OECD, 2001).

Few papers have directly addressed the rationale for biased forecasts. Zellner (1986) emphasizes asymmetric costs of forecast errors. Other studies more narrowly concentrate on the performance of private market forecasters. A paper by Laster, Bennet, and Geoum (1999) illustrates that professional private sector forecasters behave strategically, and do not provide their true unbiased estimates. Similarly, Ehrbeck and Waldman (1996) argue that forecasters will compromise between minimizing errors and mimicking prediction patterns typical of able forecasters. By doing so, they end up biasing their forecasts. These studies differ, however, fundamentally from the explanation put forward in this paper, which views the forecasts as a policy tool in a principal-agent relationship.

II. Model Synopsis

It is often argued that overstated budget revenue forecasts can be a disciplining device for an unmonitored tax administration body.[4] Put simply, the higher the target for revenue collections, the greater is the effort of the tax administration to increase collections, as long as there is a penalty for failing to meet the forecast. The rationale underlying this argument is developed below and the technical results are derived in the appendix.

The model is based on a traditional principal-agent setup, where the government as the *principal* has only limited control over its *agent*, the revenue administration. It assumes that the government is unable to directly observe revenue administration activities, and thus cannot verify whether its agent works efficiently:

[4] The paper does not try to assess whether this is an effective strategy in practice.

- The *principal's* overriding objective is to keep public approval at a high standing, which requires an efficient government apparatus. Only then is it able to produce public goods and services at minimum costs to individual taxpayers. The principal has, therefore, a keen interest to instill high performance in his agent.

- The *agent,* on the other hand, is primarily concerned with maximizing individual net payoffs. His utility is decreasing in effort and increasing in the probability of not being fired on basis of poor revenue performance .

The model shows that the *principle* can induce higher incentives through covert interference in the revenue forecast.[5] *Public approval* plays the key factor governing the relationship between the principal and agent. The model assumes that public approval for the principal depends on two factors: (i) the actual level of public service delivery, which is an increasing function in the efficiency of the public administration; and (ii) the credibility and reliability of government plans. The latter component reflects benefits from less uncertainty through accurate budget plans and declines with the degree of forecast errors. Public disapproval directly diminishes the principal's political survival chances, but also affects the tax administration negatively, which is exposed to scapegoating and punishment in case of underperformance relative to the forecasts.

Since the principal cannot control effort directly, he can utilize the disciplining effect of public disapproval on the tax administration. If benefits from overforecasting through more efficient revenue collection outweigh the costs of reduced credibility of forecast, then the principal's *overall* approval rate improves. Thus it becomes rational to intentionally bias forecasts upwards as it allows the government to produce a higher level of public services. Note however, that in the model, upward biases are not the only possible outcome. The opposite bias of understated forecasts is possible, if the public is mainly concerned with the credibility of fiscal plans and efficiency gains from higher effort by the agent are small.

Table 1 summarizes the findings from the model by characterizing the conditions for over and understated revenue forecasts. Overstated forecasts occur, if public approval is more sensitive to the efficiency of public service, while the credibility of budget plans bears little weight on the approval rate. This will more likely be the case if opportunities for rent seeking

[5] The standard solution to the principal-agent problem is the design of an incentive compatible contract for the agent (e.g., Holmström and Bengt, 1979; Grosmann and Hart, 1983), which links compensation to an observable variable, which varies with the principle's objective function and thus counterbalances the agent's conflicting goals. In the given scenario, this would suggest that the compensation of the revenue administration should be linked to the revenue collection performance (e.g., a fixed share of collected revenue is distributed as a bonus). In reality, however, such contracts are not practical, as they would be costly and face serious political opposition. First, compensation schemes would likely be expensive to discourage individual rent taking as targeting would be a problem. Second, they would be inefficient, since the role of other factors affecting revenue, such as economic growth, is quite large. Finally, they would be hard to justify politically, as their prime function is to reward noncorrupt behavior.

in the revenue administration are high or oversight is low, as in the case when the revenue administration operates independently from the ministry of finance. If, on the other hand, effort is already at a high level and public approval is affected strongly by the credibility of budget plans, then understating forecast may be rational. In intermediate cases, the forecasting bias may go either way or not materialize at all.

The key assumption underlying these results is imperfect observability of actions by the agent and a high sensitivity of public approval to an increase in effort. While biased revenue forecasts can be a rational choice, it is only a second best strategy. Unbiased forecasts are welfare improving under full observability as they generate a superior approval rate. Forecasting biases are, therefore, optimal only in the short run, while in the long run, governments should strive for establishing a tax administration that allows a first best outcome. This involves a strengthening of institutions and better abilities.

Table 1. Characterization of the Equilibrium Forecast

Principal's approval rate is sensitive to:

		Credibility of budget forecast	
		Yes	No
Efficiency of government services	Yes	?	Overstated forecast
	No	Understated Forecast	?

Source: Author's calculations.

III. Biased Revenue Forecasts: The Case of Azerbaijan

This section presents a case study evidence on the use of revenue forecasts as performance targets. Azerbaijan is, in many respects, a suitable candidate for exploring this issue. First, the institutional separation of its revenue administration from the main fiscal authority, the ministry of finance, appears to be related to poor supervision of the tax administration. Low administrative efficiency in revenue collections in the non-oil sector have been a major concern for the government. Second, the legacy of setting performance targets is still engrained in the budget preparation process This practice has been recognized in recent diagnostic studies emphasizing the lack of realism of budget revenue forecasts (IMF, 2000). Finally, alternative explanations for overstated revenue forecasts appear to be of little relevance in explaining overstated forecasts.

A. Background

Following a severe economic contraction after gaining independence in 1990, Azerbaijan has experienced a period of robust economic growth beginning in 1998. The economic expansion has been broad-based and supported by favorable developments in the oil sector and high

growth in the non-oil sector (IMF, 2002). Aggregate revenue developments have mirrored these changes with rising revenue ratios in percent of GDP, increasing from 19.8 percent of GDP to 22.6 percent in 2002, benefiting largely from oil price and crude-export increases.

Table 2. Inflation, Growth, Budget Deficit, 1998–2002

	1998	1999	2000	2001	2002
Real GDP growth (percent)	10.0	7.4	11.1	9.9	10.6
Of which: non-oil sector	4.6	2.1	13.7	10.4	12.3
CPI inflation (in percent)	-7.6	-0.5	2.2	1.3	3.3
Consolidated government deficit	-3.9	-4.7	-0.6	0.9	-0.5
Revenue as percent of GDP	19.5	18.1	20.8	21.5	22.6
Of which: non-oil revenue as percent of non-oil GDP	17.5	17.5	17.7	16.3	17.0

Source: Azerbaijan, IMF Staff Reports 2000-02.

In contrast to the overall strong revenue performance, receipts from the non-oil sector as a percent of the non-oil economy have stagnated and even declined in terms of GDP. Absent major tax policy changes, this development seems to be related to a poor performance of the tax administration and may have motivated the government to use revenue forecasts as performance indicators.

B. Institutional Independence and the Forecasting Process

In many respects, the relationship between the finance ministry and the revenue administration can be characterized as that of a principal with limited oversight over its agent. As in many transition countries, the finance ministry plans and executes fiscal policy, while its activities are constrained by the resources collected through a largely independent revenue administration. Consequently, the finance ministry is often unable to accurately assess revenue developments and, much less effectively monitor the performance of the revenue administration.

In Azerbaijan, the ministry of taxes, as the main revenue agency, operates independently of the ministry of finance. It has its own staff and headquarters and has little interaction with the ministry of finance at a technical level. One explanation for the strong institutional independence between the two institutions is access to financial sources outside the budget. Many budget users in Azerbaijan, such as line ministries, rely on own revenue funds from service fees, which are not subject to budget approval. Total extrabudgetary receipts available to line ministries were estimated at 1–2 percent of GDP in 2001.

Despite the strong position of the revenue administration within the government, political pressure to carry out reforms is high. A crucial factor is the disciplining effect of public disapproval, which in the past triggered significant reform steps. For instance, a public

meeting of the president with entrepreneurs in May 2002, recorded widespread dissatisfaction with the tax administration and subsequently led to the adoption of a far-reaching reform program. As a result, the tax administration reduced its staff by 40 percent in late 2002. A key indicator in the public's evaluation is revenue performance relative to the forecast. This process is facilitated by the government's practice of publishing revenue outturns in percent of revenue forecasts, giving the impression that they were performance targets.

The revenue forecasting process is not based on any formal rules. Until 2003, no intragovernmental working group comprising officials of the ministry of finance and the ministry of tax existed. The common practice for generating the revenue forecast was that both the ministry of finance and the ministry of taxes drafted two independent forecasts. As macroeconomic assumption were delivered by the ministry of economic development—an independent third party—differences in the forecasts were driven by different views tax elasticities and gains from administrative improvements.

Revenue forecasts were prepared at a very late stage in the budget planning process. During budget negotiations, the two forecasts were disclosed, but not necessarily reconciled. Revenue forecasts by the ministry of finance regularly exceeded the forecast by the tax administration. The official budget forecast was adopted by the minister of finance, and usually reflected the higher in house forecast.

C. Overstated Revenue in Azerbaijan

Aggregate revenue in Azerbaijan is volatile and thus difficult to predict. About one-third of state budget revenue comes from oil-related activities (Table 3). The other two-thirds stem from domestic sources and from international trade. To minimize the influence of oil price fluctuations and trade-related (external) factors, the paper concentrates on revenue from domestic non-oil sources. This revenue component amounts to roughly 40 percent of the total budget revenue.

Aggregate revenue outturns in recent years were significantly below budget forecasts. In each of the last five years, 1998–2002, non-oil revenue forecasts of the state budget consistently exceeded tax receipts from domestic non-oil sources. As Table 4 indicates, the extent of overestimation was quite large. Revenue overestimation of non-oil related activities relative to budget forecasts ranged from 12.7 percent to 34.4 percent. Measured as a percent of the total non-oil budget revenue, the forecast errors were between 7.1 percent and 16.2 percent. This deviation was quite substantial given that the non-oil budget amount to close to two-thirds of state budget revenue.

Table 3. Composition of Revenue

	Composition of State Budget Revenue	
	Percent of budget	Percent of GDP
Total Revenue	100.0	14.8
Oil Revenue 1/	34.1	4.8
Non-oil Revenue	63.9	10.3
Customs Revenue	20.9	3.1

Source: Ministry of Finance, 2001.
1/ Payments to budget by the State Oil Company.

One potential reason for these large deviations could have been too optimistic projections for macroeconomic growth. While the large forecast error in 1999 was likely related to the unexpected low GDP growth, the reverse was true in 2000–02. In all three years actual GDP growth exceeded expectations of macroeconomic developments by large margins. In other words, actual revenue outturns in 2001 and 2002 remained below the forecast despite a substantially higher rate of economic growth than projected. Thus, overoptimistic economic growth assumptions are unlikely to explain the high revenue forecast error.

Table 4. Tax Revenue Overestimation from Non-Oil Sources

	Revenue overestimation		GDP forecast and outturn	
Fiscal year	Percent of forecast	Percent of non-oil budget	Actual: annual growth rate	Forecast: annual growth rate
1998 1/	28.8	...	...	...
1999	34.4	16.2	2.1	7.0
2000	17.7	9.6	13.7	4.2
2001	14.9	8.2	10.4	8.5
2002	12.7	7.1	12.3	9.0

Source: Ministry of finance and staff calculations.
1/ Based on estimates.

Alternatively, the effects from changes in tax policy could have been underestimated, and thus, led to large forecast errors. However, the major recent tax policy change, a 2 percentage point reduction of the VAT rate in 2001, did not lead to significant revenue losses, and, thus, is unlikely to account for low non-oil revenue collections. In general, revenue forecasts for individual taxes mirror the overestimation of revenue at the aggregate level and thus support the hypothesis of overstated revenues.

One should, however, be cautious with the interpretation of these results given the short time period covered. Systematic forecast errors (i.e., multiple periods of forecast errors in one

direction) need not be the result of deliberate actions, such as political manipulation or an explicit policy bias. Experience from industrial country studies shows that systematic forecast errors can also be the result of a forecaster's Bayesian updating strategy leading to serial correlation in the forecast errors (Auerbach, 1999; Penner, 2001). Unfortunately, lack of time series data does not allow to empirically evaluate this possibility. Thus, while the presented case study evidence supports the incentive model, more evidence is needed to support the model-based explanation of revenue forecasts as performance targets.

IV. Conclusions and Outlook

Anecdotal evidence on systematically biased revenue forecasts is plentiful, but the underlying motivation is often not well understood. This study gives one explanation for rationally biased revenue forecasts. By highlighting the role of underdeveloped institutional capacities, namely imperfect control of the government over its revenue administration, the paper shows that biased forecasts can be a second-best tool to increase unmonitored revenue collection effort. Overstated forecasts generate high public performance expectations and thus make poor effort and governance more costly.

Case study evidence of recent forecasting performance and practices in Azerbaijan gives an intuitive underpinning for this argument. The government's inability to monitor the revenue administration has likely led to the use of overstated revenue forecasts with the goal of exposing the performance of the revenue administration to greater public scrutiny. As a result, the revenue administration has an incentive to increase efficiency and produce higher revenue. While intuitively appealing, a lack of data and an empirical counterfactual do not allow us to assess whether this policy actually had the desired effect on revenue outturns.

This study recognizes that intentional forecast biases are only a second-best policy tool. Strengthening institutions through capacity building in the tax administration and improved cooperation between government bodies is a superior strategy. These reforms allow both the development of incentive-compatible compensation schemes and the use of realistic budget forecasts. Therefore, while biased revenue forecasts may be rational in a weak institutional environment, administrative reforms should be the overriding reform objective for policymakers.

A Political Economy Model of Revenue Forecasting

The model assumes three different groups of agents: (i) *general population* comprising individuals concerned about the provision of public services; (ii) the *fiscal authority* maximizing public approval; and (iii) the *revenue administration* maximizing expected income from its operations.

The general population

Each individual is endowed with one unit of labor. Individuals differ in their level of public concern $\zeta^i > 0$, measuring an individual's reservation utility, which needs to be met in order to generate public approval. Highly concerned individuals require a high level of satisfaction with public services (i.e., high utility) in order to approve of the government.

The level of public concern ζ^i is uniformly distributed between [0, Z] with Z > 0, so that the population density function measured along ζ is given by $f(\zeta) = 1/Z$. Total population size is *N=1*. Individual approval of the government is expressed through the indicator function:

$$\alpha^i = \begin{cases} 1 & if \quad u^i \geq \varsigma^i \\ 0 & otherwise \end{cases} .$$

Since all individuals are equally endowed, individual utility is the same for everyone ($u^i = u$, for all i) so that the public approval rate *is* given by:

$$\alpha = F(\zeta < u) = 1/Z \;\; u < 1$$

as long as *Z* is sufficiently large.

Individual utility increases in private and public consumption *(C, G)* and the degree of satisfaction with budget planning performance Ψ (discussed below).[6]

$$u = u\,(C, G, \Psi) \qquad (1)$$

Private consumption is equal to after tax income $C = Y - R$ with income $Y = Y(\eta)$ being random, with cdf $\Phi(\eta)$, and revenue $R = Y\,\tau(e)$ depending on the tax rate $\tau(e)$, which itself is a function of effort (honesty) *e* by the revenue administration. Tax collections increase in effort $\tau_e > 0$. The public good *G* is nonrival in consumption and its production is characterized by economies of scale. Production of G is financed by tax revenue. The model assumes a balanced budget constraint and a predetermined level of the statutory tax rate. By inference *R* has a cumulative distribution function $\Phi(\eta,e)$ with $\Phi_e < 0$ assuming stochastic dominance.

[6] Since *N=1* individual superscripts can be omitted so that $c^i = C/N = C$ and $g^i = G/N = G$.

Finally, Ψ denotes the degree of satisfaction with the perceived budget planning performance of the government, and captures the effect of government credibility. Unforeseen revenue collection in excess of the forecast $\hat{R}$ have a positive effect, while unexpected revenue shortfalls have a damaging effect. Whether or not the reputational costs is high depends on two factors: (i) whether the fiscal authority decides to deflect the reputational damage on its revenue administration (λ=1,0); and (ii) how effective this strategy is ($\rho \in [0.1]$):

$$\Psi = (1 - \lambda\rho)(R^2 - \hat{R}^2) \tag{2}$$

The term $(R^2 - \hat{R}^2)$ reflects asymmetric utility payoff from unforeseen forecast errors. If R< $\hat{R}$, the principal can lay off the revenue administration (λ =1) and partially deflect disapproval so that he bears only a fraction (1-ρ) < 1 of the reputational loss.

Fiscal authority—the principal

The fiscal authority's main objective is to maximize its expected public approval rate by choosing $\hat{R}$:

$$Max_{\hat{R}}\ E\,\alpha = \frac{1}{Z}\ E\,u(C, G, \Psi) \tag{3}$$

The choice of $\hat{R}$ affects approval through two channels, by affecting Ψ through its effect on the forecasting accuracy, and two, through its impact on effort and its effect on the level of public services G. Assuming linear additive separable utility, the maximization problem simplifies to

$$Max_{\hat{R}}\ E\,\alpha = 1/Z\ E[\,Y + (\gamma - 1)R - (1 - \lambda\rho)(\hat{R}^2 - R^2)\,] \tag{4}$$

where γ >1 measures the effect of increasing returns in producing the nonrival public good.[7] Finally, under asymmetric reputational costs Ψ, the fiscal authority's layoff policy is given by the rational decision:

$$\lambda = \begin{cases} 1 & R \le \hat{R} \\ 0 & otherwise \end{cases}$$

[7] Separability simplifies the analysis by neutralizing utility spillovers from complementarities between private and public goods consumption. Linearity rules out potential level effects related to the choice of government size. For the sake of simplicity, γ is assumed to be a fixed parameter, which can, however, only locally exceed 1 to justify a statutory tax rate < 1. We have abstracted from this possibility.

Revenue administration—agent

The agent maximizes expected income *I* from wages minus concave cost κ of exerting effort or being honest.

$$\text{Max}_{\,e}\, E\ I = (1 - \Phi(\hat{R}, e))\, W - \kappa(e) \tag{5}$$

The term (1-Φ ($\hat{R}$,e)) measures the likelihood of remaining on the job. Φ ($\hat{R}$,e) captures the probability that R< $\hat{R}$ and thus the ex ante probability for the agent of being laid off (i.e., Prob (λ=1) which is increasing in $\hat{R}$ and decreasing in *e*).

First best outcome

In an ideal world, the fiscal authority imposes an optimal level of effort and produces unbiased revenue forecasts. Two key assumptions are necessary for this result. These are full observability of *e* and public knowledge of the distribution function *R.* Since the fiscal authority observes *e*, it can enforce any level independent of the level of the revenue forecast, (i.e., $e_{\hat{R}} = 0$). Similarly, the revenue forecast is unbiased, since the public knows the random nature of collections, and its approval rate cannot be influenced by a biased revenue forecast; thus $E\,\Psi_{\hat{R}} = 0$ .Under these conditions, the principal can now reach a first best approval rate α^{**} which pareto dominates the second best rate under unobservable effort (i.e., $\alpha^{**} \geq \alpha^{*}$).

Choice of effort level under unobservable *e*

As exerting effort is costly to the agent, the agent has to choose between a likely low-revenue outturn through low effort (and thus a higher probability of being fired) and the direct costs of exerting effort. The optimal level of effort is determined by the agents' first-order condition for the choice of *e*:

$$-\Phi_e(\hat{R}, e)\, W - \kappa_e = 0 \tag{6}$$

The condition states that at the margin benefits through an increased likelihood of being still employed at the end of the period must be equal to the marginal cost of effort. Implicit differentiation shows that the effort level increases in the level of revenue forecast, if $\Phi_{e\hat{R}} < 0$ and $\Phi_{ee} > 0$:

$$\frac{de^*}{d\hat{R}} = \frac{\Phi_{e\hat{R}} W}{-\Phi_{ee} W - \varphi_{ee}} > 0. \tag{7}$$

The condition $\Phi_{e\hat{R}} < 0$ implies that a higher revenue forecast increases the effectiveness of the agent's marginal effort to keep her position. The second condition $\Phi_{ee} > 0$ indicates that

exerting effort increasingly reduces the likelihood of being fired by reducing the likelihood of a low-revenue outturn.

Optimal forecast level under unobservable *e*

This section examines the factors determining the equilibrium level of the revenue forecast chosen by the fiscal authority. Utilizing previous results, the optimization problem for the principal can be rewritten as

$$Max_{\hat{R}}\ E\alpha = 1/Z\,[\,EY + (\gamma - 1)\,E\,R(e^{*}(\hat{R})) - \cdots$$

$$\cdots - (\int_{0}^{\hat{R}} (1-\rho)(\hat{R}^2 - R^2) + \int_{\hat{R}}^{\infty} (\hat{R}^2 - R^2))\, f(R, e(\hat{R})\ dR\,]\,. \tag{8}$$

The revenue forecast affects the approval rate through two different channels: (i) through its effort linked effect on public services; and (ii) through its impact on public credibility. Four main marginal effects influence the principal's choice of $\hat{R}$:

$$\frac{d\alpha}{d\hat{R}} = 1/Z\,[\ (\gamma - 1)\ ER_e e_{\hat{R}} - 2\hat{R}(1 - \rho\,\Phi(\hat{R})) + \cdots$$

$$\cdots - (1-\rho)\int_{0}^{\hat{R}} (\hat{R}^2 - R^2) f_{e^*} e_{\hat{R}}\, dR - \int_{\hat{R}}^{\infty} (\hat{R}^2 - R^2) f_{e^*} e_{\hat{R}}\, dR\,]\,. \tag{9}$$

The first term inside the square brackets describes approval gains from increased public goods production. As higher revenue forecasts lead to more effort, more revenue comes in and more public goods can be produced. The size of this effect is determined among other factors by the level of γ, which can be viewed as the population's preference for public goods delivery.

The other three terms capture the direct and indirect effects of the revenue forecast on government credibility. The second term measures expected credibility costs of increasing the forecast at a given level of revenue. In other words, it measures the utility loss from lower credibility through a marginally higher forecast, while keeping the probability of a certain outcome unchanged. Without the possibility of political deflection, (i.e., ρ=0), the marginal cost would increase by $2\hat{R}$, reflecting the quadratic cost function of loosing credibility Ψ. The third and the fourth terms capture the expected credibility change due to higher induced effort. Since changes in *e* alter the df of *R*, the principal's approval rate is affected. In general, however, the third and the fourth components cannot be signed without specifying the distribution function for *R*.

Understated and Overstated Forecasts – Simulation results

Forecast bias is defined as a deviation between the expected level of revenue and the equilibrium budget forecast provided by the principal, or

$$E\,[\,\mathrm{R}(\,\mathrm{e}^{*}(\,\hat{R}^{*}))\,]\neq\,\hat{R}^{*}\,. \tag{10}$$

As the previous discussion has already indicated, the properties of $\hat{R}^{*}$ cannot be determined without specifying the distribution function for *R*. It is, therefore, assumed that *R* follows an exponential distribution function with an expected revenue of *E(R)= e*. The exponential distribution satisfies the requirement of stochastic dominance and also meets the two conditions for an increasing optimal effort level ($\Phi_{e\hat{R}}>0,\ \Phi_{ee}>0$). Furthermore, it simplifies the identification of a rationally biased forecast, since $e^{*}=\mathrm{E}(\hat{R}^{*})$ so that the condition for bias reduces to

$$\mathrm{e}^{*}(\hat{R}^{*})\neq\hat{R}^{*}\,. \tag{11}$$

Since a closed form characterization of the equilibrium forecast is not possible, the existence of understated and overstated revenue forecasts was determined through numerical simulations. A schematic representation of the results is depicted in figures 1 and 2.

Figure 1. Overstated Revenue: Approval Rate and Optimal Effort Level

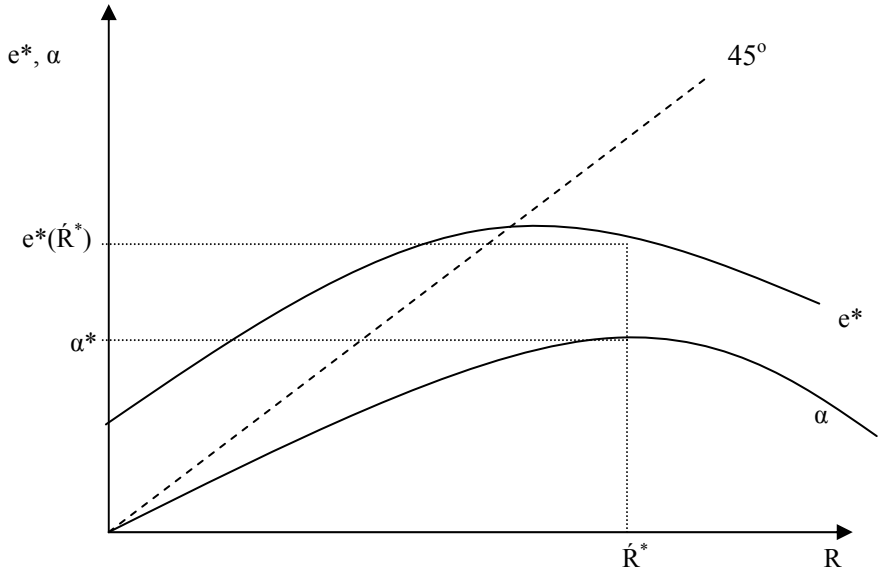


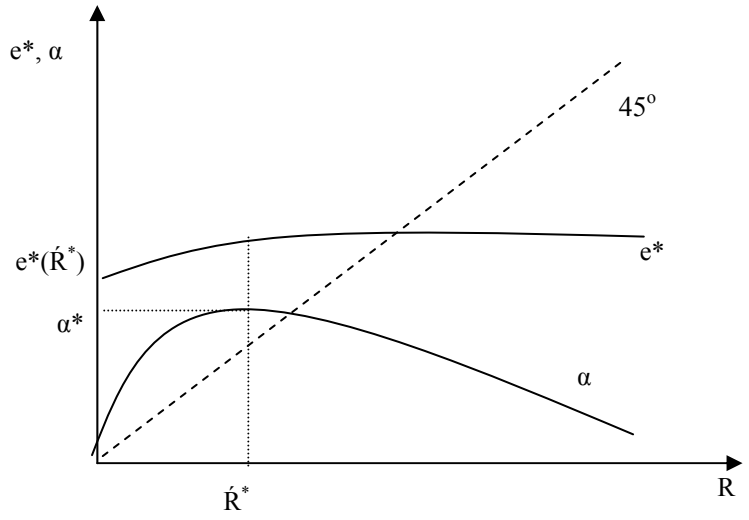
Figure 1 shows the case of overstated revenue forecasts. The inverse U-shaped line depicts the approval rate for the principal and thus his objective function. Initially, the approval rate

increases with a growing forecast, as the effect of greater delivery of public services through higher effort dominates. As the forecast further increases, the agent begins to exert less additional effort and the principal starts experiencing fewer revenue gains, as well as reputational damage from lower revenue outturns.

This effect increases until the approval rate declines. In Figure 1, the agent's optimal choice of effort is depicted by the upper convex line. Every point on this schedule represents the agent's optimal choice of *e* for a given forecast. As can be seen from the graph, the principal's optimal choice of the revenue forecast lies to the right of the intersection of the agent's optimal effort schedule and the 45 degree line. This means that $e^*(\hat{R}^*) < \hat{R}^*$ so that the forecast is biased upwards.

Figure 2 depicts the case of an understated revenue forecast. The flat optimal effort schedule assumes that effort is only slightly affected by the revenue forecast. This would be the case when the costs of exerting effort or even partially observable effort are high.[8] Relative to Figure 1, the optimal revenue forecast $\hat{R}^*$ is small and lies to the left of the intersection with the 45 degree line so that $e^*(\hat{R}^*) > \hat{R}^*$. The revenue forecast therefore understates expected revenue.

Figure 2. Understated Forecasts: Approval Rate and Optimal Effort Level



[8] Under the conditions of observable effort, the principal can enforce any level of effort independent of what level of forecast has been chosen. This is the case in governments with an effective administration.

Factors influencing the forecast bias

It is now possible to determine factors affecting the equilibrium choice of the optimal forecast level. Factors increasing the equilibrium forecast level $\hat{R}^*$ are that:

- γ is large, so that additional effort is essential to gain public approval.
- ρ is close to one, implying that credibility losses from overstated revenue can be deflected at little reputational cost.
- the effort level $e_{\hat{R}} > 0$ is sensitive to the forecast, and $\Phi_e < 0$ small. The principal can then benefit from a overstated forecast, knowing that higher revenue collections are likely to materialize.

More generally, simulation results show that the presence of overstated or understated equilibrium forecasts depends on the relative significance of two factors: the preference for public goods delivery γ, and the ability to contain credibility losses through deflection ρ. Overstated forecasts are possible, if the public approval is more sensitive to the efficiency of public service (i.e., γ is high) while the credibility of budget plans bears little weight on the approval rate (ρ close to 1). If, on the contrary, public approval is affected strongly by the credibility of budget plans (ρ close to 0), then an understated forecast may be a rational policy. In intermediate cases, the forecasting bias may go either way or not materialize at all.

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).

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.

Bretschneider, S., and others, 1989, "Political and Organizational Influences on the Accuracy of Forecasting State Government Revenue," *International Journal of Forecasting*, Vol. 5, No. 3, pp. 307–19.

Bretschneider, S., and W. 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.

Cassidy, G., M. Kamlet, and D. Nagin, 1989, "An Empirical Examination of Bias in Revenue Forecasts by State Governments," *International Journal of Forecasting,* Vol. 5, No. 3, pp. 321–31.

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," *Quarterly Journal of Economics*, Vol. 111, No. 1, pp. 21–40.

Grossman, Sanford J., and Oliver D. Hart, 1983, "An Analysis of Principal-Agent Problem," *Econometrica*, Vol. 51 (January), pp. 7–46.

Holmström, Bengt, 1979, "Moral Hazard and Observability," *Bell Journal of Economics,* Vol. 10, No. 1, pp. 74–91.

International Monetary Fund, 2000, *Report on the Observance of Standards and Codes, Azerbaijan Republic.* Available via the Internet: http://www.imf.org/external/np/rosc/aze/

———, 2002, *Azerbaijan—Staff Report on the 2002 Article IV Consultations.* Available via the Internet*:* http://www.imf.org/

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.

Musso, Alberto, and Steven Phillips, (2002), "Comparing Projections and Outcomes of IMF-Supported Program," IMF Staff Papers Vol. 49, No. 1, pp. 22–48 (Washington: International Monetary Fund).

OECD, 2001, *Managing Public Expenditure*, edited by Richard Allena, and Daniel Tommasi, Paris.

Penner, Rudolph G., 2001, *Errors in Budget Forecasting* (Washington: The Urban Institute).

Pike, Tim, and D. Savage, 1998, "Forecasting the Public Finances in the Treasury," *Fiscal Studies,* Vol. 19, No. 1, pp. 49–62.

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.

Schroeder, L., and M. Wasylenko, 1989, "Public Sector Forecasting in the Third World," *International Journal of Forecasting*, Volume 5, No. 3, pp. 333–45.

Zellner, Arnold, 1986, "Rationality and the Evaluation of Forecasts," Biased Predictors, University of Southern California Modeling Research Group Working paper, No. 9403, Los Angeles.