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Determinants of Tax Revenue Efforts in Developing Countries

Abhijit Sen Gupta

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AFR

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Abstract

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The views expressed in this Working Paper are those of the author(s) and do not necessarily represent those of the IMF or IMF policy. Working Papers describe research in progress by the author(s) and are published to elicit comments and to further debate.

This paper contributes to the existing empirical literature on the principal determinants of tax revenue performance across developing countries by using a broad dataset and accounting for some econometric issues that were previously ignored. The results confirm that structural factors such as per capita GDP, agriculture share in GDP, trade openness and foreign aid significantly affect revenue performance of an economy. Other factors include corruption, political stability, share of direct and indirect taxes etc. The paper also makes use of a revenue performance index, and finds that while several Sub Saharan African countries are performing well above their potential, some Latin American economies fall short of their revenue potential.

JEL Classification Numbers: H11, H20.

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I. INTRODUCTION

Reaching the Millennium Development Goals (MDGs) will require a concerted effort from both developed and developing countries. Aid from developed countries will have to rise significantly to achieve the MDGs. Although the donors have pledged to increase development aid by US\$18.5 billion (from a 2002 level of US\$58 billion), the World Bank (2004) estimates that developing countries could effectively use at least US\$30 billion initially. The developed countries also need to aim for improved market access for developing countries' exports by eliminating tariffs and domestic subsidies.

However, because excessive reliance on foreign financing may in the long run lead to problems of debt sustainability, developing countries will need to rely substantially on domestic revenue mobilization. The experience with domestic resource mobilization of developing countries over the last 25 years has been mixed. In countries such as Botswana, Israel, Kuwait and Seychelles, the central government revenue's share in GDP has been more than 40 percent on average. On the other hand, countries such as Argentina, Niger, Guatemala and Burkina Faso have struggled to raise their revenue above 11 percent.

In this paper we investigate the main factors that may explain the variation in resource mobilization of developing countries. More specifically, we look at the main determinants of revenues (excluding grants) of the central government, and analyze the extent to which factors such as government policies, the structure of the economy, institutions and the stage of development explain their variation. While a number of studies have analyzed the principal determinants of tax revenue, in this paper we extend the literature by using a broader dataset and correcting for some of the econometric issues that were previously ignored. The dataset is extended by using a larger number of countries over a sufficiently long time horizon. Moreover, we incorporate new variables such as specific sources of tax revenue, political stability, economic stability, law and order etc. as potential determinants of revenue performance. We address some potential econometric problems by employing econometric specifications that take into account, among other things, the persistence of revenue performance and the possibility of some of the explanatory variables being influenced by revenue performance.

Our principal findings are that structural factors such as per capita GDP, share of agriculture in GDP, and trade openness are strong determinants of revenue performance. We also find that although foreign aid improves revenue performance, foreign debt does not have a significant effect. Among the institutional factors, we find that corruption is a significant determinant of a country's revenue performance. Political and economic stability matters as well, but this finding is not robust across specifications. Finally, we find that those countries that depend on taxing goods and services as their primary source of tax revenue, have relatively poor revenue performance. On the other hand, countries that rely more on income taxes, profit taxes, and capital gains taxes, perform much better.

We also construct a revenue performance index that allows us to compare actual revenue performance with predicted revenue performance. We find that several African countries, including a number of countries from Sub-Saharan Africa, perform significantly better than predicted. However, several countries from Latin America and Eastern Europe perform below their predicted revenue performance.

After reviewing the literature, we briefly describe the data. Then we introduce the empirical model and discuss the main econometric results. Next, we develop the revenue performance index and use this index to rank countries. To end, we conclude and make some policy recommendations.

II. RECENT RESEARCH FINDINGS

What affects revenues (measured as the ratio tax revenues to GDP) has been the subject of a long debate. Before turning to the evidence, we discuss factors that are typically included in the specifications. Researchers have included several variables such as per capita GDP, the sectoral composition of output, the degree of trade and financial openness, the ratio of foreign aid to GDP, the ratio of overall debt to GDP, a measure for the informal economy, and institutional factors such as the degree of political stability and corruption as potential determinants of revenue performance.

Per capita income is a proxy for the overall development of the economy and is expected to be positively correlated with tax share as it is expected to be a good indicator of the overall level of economic development and sophistication of the economic structure. Moreover, according to Wagner's law, the demand for government services is income-elastic, so the share of goods and services provided by the government is expected to rise with income. The sectoral composition of output also matters because certain sectors of the economy are easier to tax than others. For example, the agriculture sector may be difficult to tax, especially if it is dominated by a large number of subsistence farmers. On the other hand, a vibrant mining sector dominated by a few large firms can generate large taxable surpluses.

The degree of international trade—measured by the share of exports and imports—should also matter for revenue performance. Imports and exports are amenable to tax as they take place at specified locations. Furthermore, most developing countries shifted away from trade taxes in the 1990s, which was largely due to the widespread liberalization of trade undertaken under the Uruguay Round. The effect of trade liberalization on revenue mobilization may be ambiguous. If this liberalization occurs primarily through reduction in tariffs then one expects losses in tariff revenue. On the other hand, Keen and Simone (2004) argue revenue may increase provided trade liberalization occurs through tariffication of quotas, eliminations of exemptions, reduction in tariff peaks and improvement in customs procedure. Rodrik (1998) also points out that there is a strong positive correlation between trade openness and the size of the government, as societies seem to demand (and receive) an

expanded role for the government in providing social insurance in more open economies subject to external risks.

The degree of external indebtedness of a country may affect revenue performance as well. To generate the necessary foreign exchange to service the debt, a country may choose to reduce imports. In such a scenario, import taxes will be lower. Alternatively, the country may choose to increase import tariffs or other taxes with a view to generate a primary budget surplus to service the debt.

Foreign aid has also been identified as a factor that may affect revenue performance. A key distinction appears to be whether the aid is used productively or simply to finance current consumption expenditures. Moreover, the composition of aid has an important effect on revenue performance. For example, Gupta et al. (2004) find that concessional loans are associated with higher domestic revenue mobilization, while grants have the opposite effect.

The empirical findings have been mixed because of their sensitivity to the set of countries and the period of analysis.² The majority of these studies employ cross section empirical methods and hence ignore on the variation over time. Lotz and Morss (1967) find that per capita income and trade share are determinants of the tax share, and this finding has been replicated since (e.g., see Piancastelli (2001)). Chelliah (1971) relates the tax share to explanatory variables such as mining share, non-mineral export ratio and agriculture share. Several studies, including Chelliah, Baas and Kelly (1975) and Tait, Grätz and Eichengreen (1979), update Chelliah (1971) and obtain similar results. In a related study covering developing countries, Tanzi (1992) finds that half of the variation in the tax ratio is explained by per capita income, import share, agriculture share and foreign debt share. Recently, some studies have looked at the importance of institutional factors in determining revenue performance. For example, Bird, Martinez-Vasquez and Torgler (2004) find factors such as corruption, rule of law, entry regulations play key roles.

Several regional studies have looked into determinants of resource mobilization. For sub-Saharan African countries, Tanzi (1981) finds that mining and non-mineral export share positively affect the tax ratio. Focusing on the same region, Leuthold (1991) uses panel data to find a positive impact from trade share, but a negative one from the share of agriculture. In a similar study, Stotsky and WoldeMariam (1997) find that both agriculture and mining share are negatively related to the tax ratio, while export share and per capita income have a positive effect. They also find a positive but weak link between IMF programs and tax share. Ghura (1998) concludes that the tax ratio rises with income and degree of openness, and falls with the share of agriculture in GDP. He also finds that other factors like corruption, structural reforms and human capital development affect the tax ratio. While a rise in

² The reader finds a tabulated summary of these papers in Appendix D.

corruption is linked with a decline in tax ratio, structural reforms and an increase in the level of human capital is associated with an increase in tax ratio. In a study of Arab countries, Eltony (2002) observes that mining share has a negative impact on the tax ratio for oil exporting countries, but a positive impact for non-oil exporting countries.

To summarize, most studies find that per capita GDP and degree of openness is positively related to revenue performance, but a higher agriculture share lowers it. The effect of mining share and revenue performance is ambiguous. Studies such as Tanzi (1991) and Eltony (2002) found that foreign debt is positively related to resource mobilization.

III. DATA DESCRIPTION

We use a panel dataset that covers 105 developing countries over 25 years. The choice of countries and years is primarily motivated by the desire to use consistently measured variables. Table 1 gives summary statistics of the key variables. The variable of interest is central government revenue (excluding grants) as a percentage of GDP, and is taken from *Government Financial Statistics* (GFS) and *WEO Economic Trends in Africa* (WETA). Among the explanatory variables, we include structural variables such as per capita GDP, share of agriculture in GDP, share of manufacturing in GDP, share of imports in GDP, ratio of debt and aid to GDP. Their sources are primarily the *International Financial Statistics* (IFS) and *World Development Indicators* (WDI). Information on the proportion of tax revenue collected from goods and services, income profit and capital gains, and trade comes from GFS, and information on the highest marginal tax rate (for corporate and individual tax

Table 1: Summary of the Variables

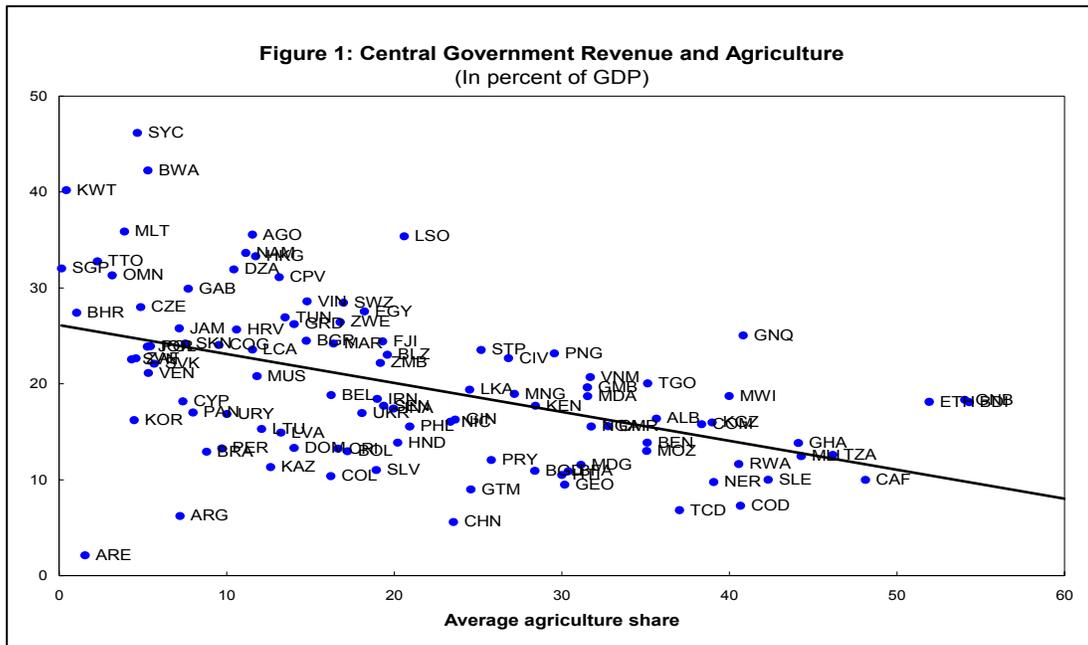
Variable	Source	No. of Obs.	Percentage Available	Mean	Std. Dev	Min	Max
Central government revenue (% of GDP)	GFS & WETA	2,013	67.1	19.8	13.2	-225	79.33
Per capita GDP in PPP	WDI	2,587	86.2	8.1	0.9	6	10.72
Agriculture, value added (% of GDP)	WDI	2,448	81.6	21.8	14.5	0	72.03
Imports (% of GDP)	WDI	2,551	85.0	43.0	22.8	3	173.48
Aid (% of GNI)	WDI	2,562	85.4	8.6	13.4	-1	210.56
Debt (% of GNI)	IFS	2,277	75.9	5.8	4.9	0	80.76
Tax revenue from goods and services (% of total revenue)	GFS	756	25.2	28.3	15.3	0	76.74
Tax revenue from income, profits and capital gains (% of total revenue)	GFS	736	24.5	20.6	12.9	0	79.54
Tax revenue from trade (% of total revenue)	GFS	747	24.9	16.5	14.2	1	64.66
Tax revenue from exports (% of total revenue)	GFS	290	9.7	2.8	5.9	0	51.68
Highest marginal tax rate, individual rate (%)	WDI	386	12.9	31.0	13.3	0	60
Highest marginal tax rate, corporate rate (%)	WDI	385	12.8	28.3	8.8	0	54
Political stability	ICRG	1,711	57.0	57.7	13.7	9	90
Economic stability	ICRG	1,711	57.0	31.0	7.4	3	49.5
Corruption	ICRG	1,722	57.4	2.8	1.1	0	6
Law and order	ICRG	1,688	56.3	3.2	1.3	0	6
Government stability	ICRG	1,722	57.4	7.1	2.5	0	12
Average tariff	IMF	944	31.5	6.9	7.7	0	45

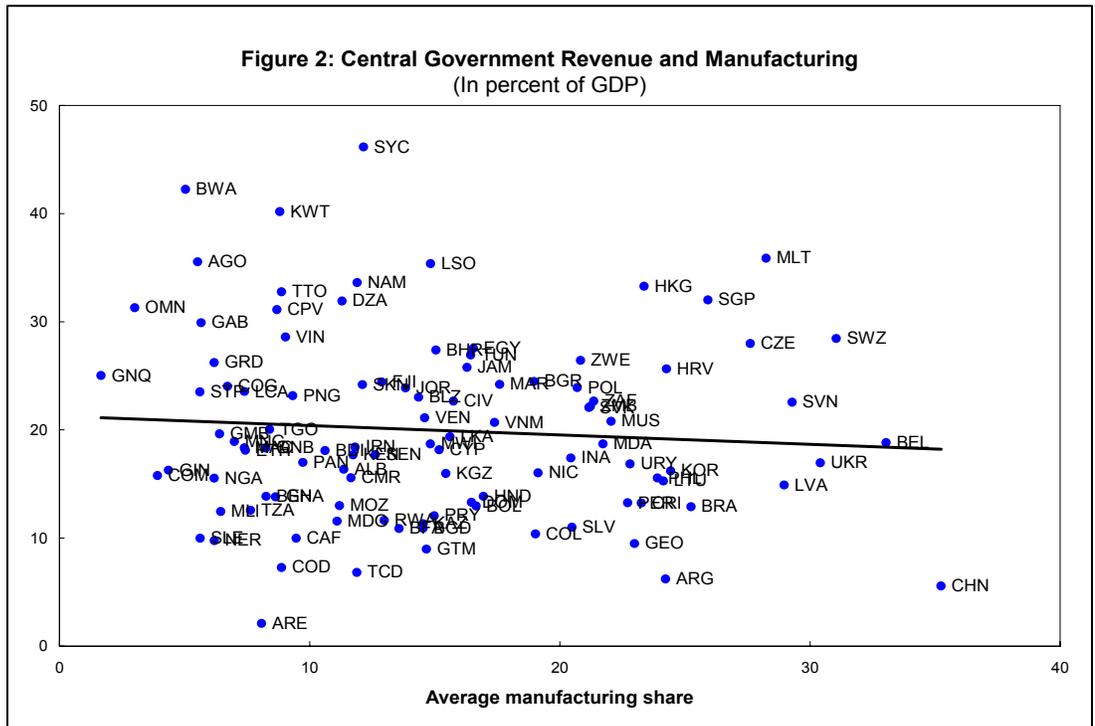
rates) is from the WDI. We include the Trade Restrictiveness Index, which has a measure for average tariffs and which ranks countries based on non-tariff barriers and tariff rates. Finally, we use variables that capture institutional factors such as political stability, economic stability, corruption, law and order and government stability. These are obtained from the *Intra Country Risk Guide* (ICRG) dataset. We define those measures such that a higher number implies a better state of the world.

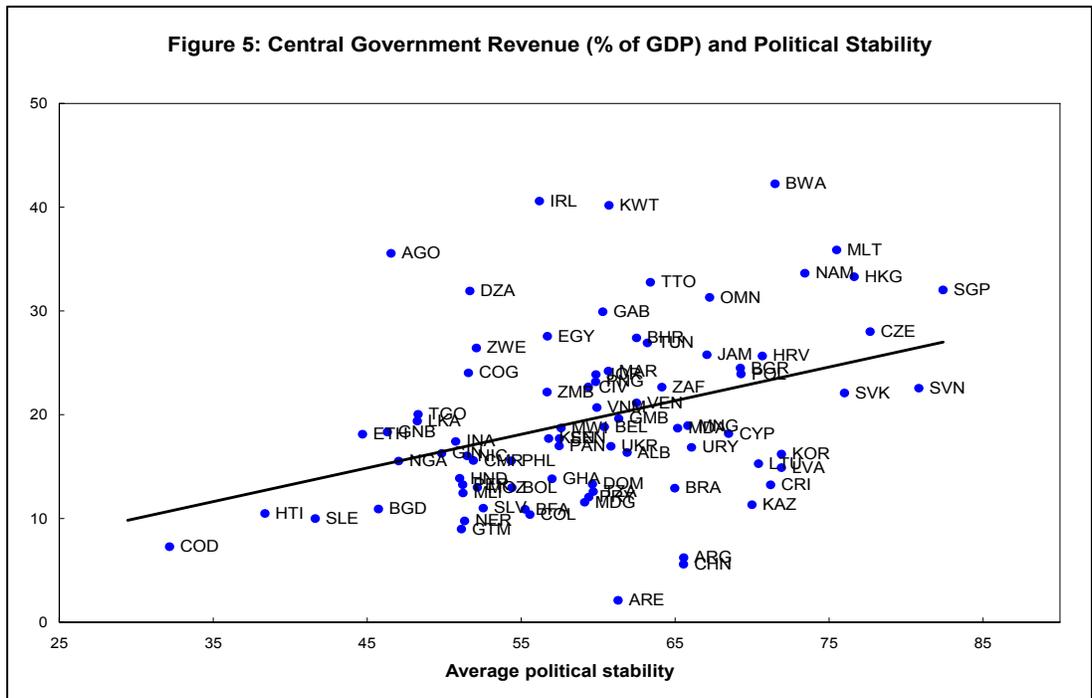
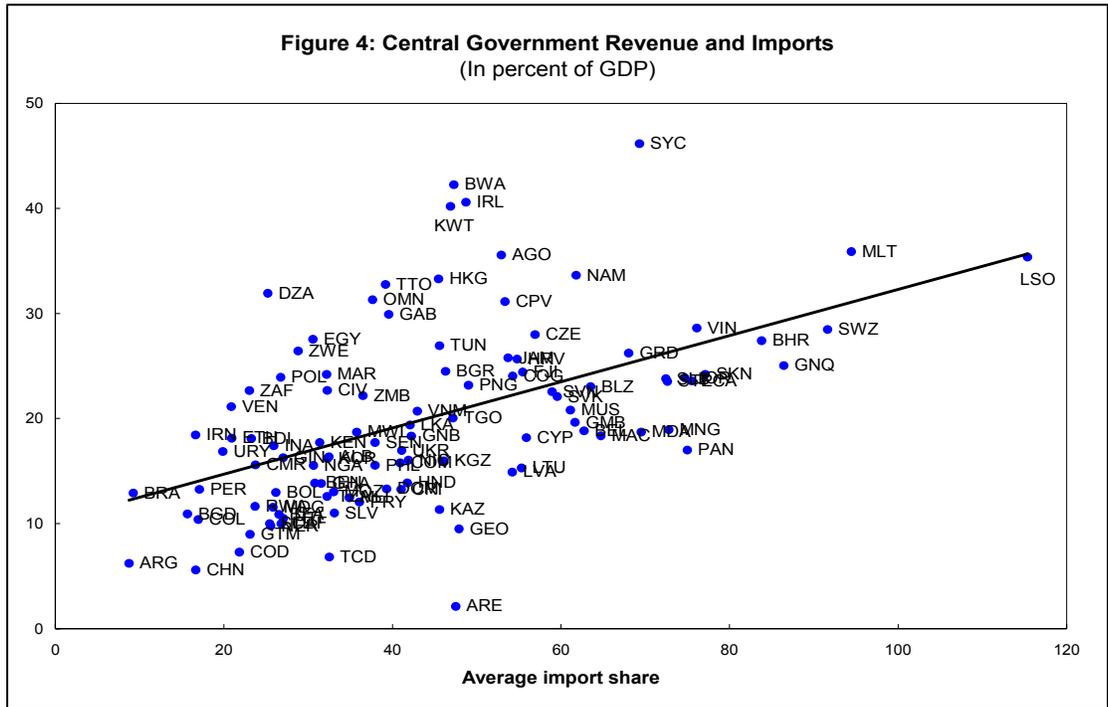
IV. EMPIRICAL ANALYSIS

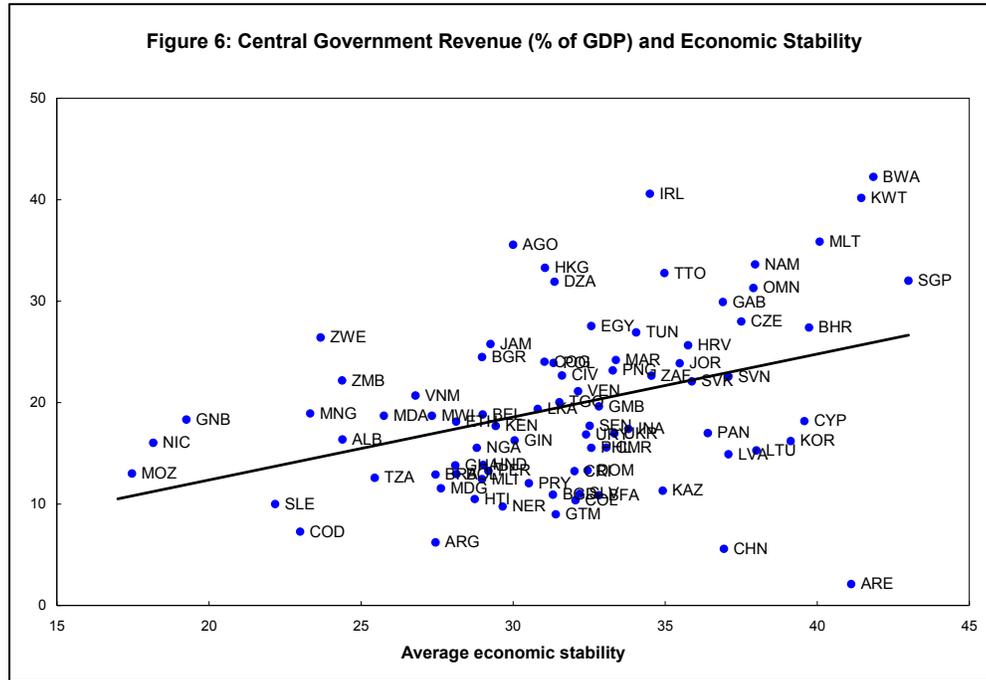
A. Graphical Analysis

Before we turn to the regression results, we briefly show the observed relationship between revenue performance and some explanatory variables (see Figures 1-6). A first observation is that agriculture share appears to have a strong negative relationship with revenue performance. There is no apparent correlation between manufacturing share and revenue performance. It also appears that per capita GDP and import share have a strong positive relationship with revenue performance. Similarly, political and economic stability appear strongly related to revenue performance.









B. Baseline Regression Analysis

In our baseline panel regressions we use fixed and random effects specifications. The fixed effect assumes that certain country-specific characteristics are not captured by the explanatory variables, and that these are uncorrelated with the error term. The fixed effect specification is

$$y_{it} = \alpha_i + \beta.X_{it} + \gamma.Y_{it} + \delta.Z_{it} + \varepsilon_{it},$$

where y_{it} is the ratio of central government revenue (excluding grants) to GDP in country i during period t , α_i is the country fixed effect, X_{it} is set of structural variables, and the vectors Y_{it} and Z_{it} include institutional and policy variables. Alternatively, the random effects specification is

$$y_{it} = \alpha + \beta.X_{it} + \gamma.Y_{it} + \delta.Z_{it} + u_i + \varepsilon_{it},$$

with u_i the random effect.

The structural variables include the log of per capita GDP, the share of agriculture in GDP, the ratio of imports to GDP, share of aid and debt in GDP. The institutional variables include corruption, law and order, government stability, political stability and economic stability.

Finally, the policy variables include the various sources of tax revenue as a percentage of revenue, the highest corporate and income tax rate, and average tariffs.

The results of the baseline regressions, using the fixed- and random-effects specifications, are summarized in Tables 2 and 3. Wherever necessary, the regressions also include dummies for landlocked and resource-rich countries.³ The standard errors are adjusted for intra-group correlations. Because of the high degree of collinearity between the agriculture share and the log of GDP per capita ($R^2 = 0.81$), we use those variables in separate specifications.

A first finding is that coefficient on log of per capita GDP is significantly positive in all the random-effects regressions and in most fixed-effects specifications. This is in line with other studies that found that the capacity to collect and pay taxes increases with the level of development (see for example Chelliah, 1971).

Our results also suggest a strong negative and significant relationship between agriculture share and revenue performance. For example, a one percent increase in the share of agriculture sector could reduce revenue performance by as much as 0.4 percent. This relationship could work through both the supply and the demand side. On the supply side, if a large part of the agriculture sector is subsistence, then this sector may be hard to tax. Moreover, it may be politically infeasible to tax the agriculture sector. On the other hand, a large agriculture sector may reduce the need to spend on public goods and services, which tend to be relatively urban-based.

Next, in most specifications we find a strong positive relationship between openness and revenue performance. For example, an increase in the ratio of imports to GDP of one percent may increase revenue performance by up to 0.15 percent. One explanation for this finding is that trade-related taxes are easier to impose because the goods enter or leave the country at specified locations.

We also find that foreign aid has a positive effect on revenue performance, but the relationship appears weaker than that for some other variables. Gupta et al. (2004) had already pointed out that if foreign aid comes primarily in the form of loans, then the burden of future loan repayments may induce policymakers to mobilize higher revenues. However, aid in the form of grants may create a moral hazard problem if it decreases incentives to increase the tax base. We found that debt is negatively related with revenue performance, although the relationship is not very strong.

Our results for the institutional factors are mixed. We do not find a significant effect from the variables that capture government stability, corruption, and law and order. However, across

³ The dummy variable for resource rich countries takes on value 1 if the share of minerals and ores in the host country's exports exceeds 50 percent or if the host is an oil exporting country.

some specification, the impact is significant when institutions are measured by political and economic stability.

We also investigate how the various sources of tax revenues affect the share of central government revenue in GDP. We find that countries that rely more on taxes on goods and services as a source of revenue have lower revenue performance. Since most of the taxes on goods and services are indirect taxes, they tend to be regressive in nature. As a result, they may exacerbate the inequality in income distribution and reduce the tax base, which in some cases may result in a reduction in the share of revenue in GDP. In contrast, greater reliance on taxation of income, profits and capital gains appears to improve revenue performance. To the extent that these taxes are progressive, they reduce income dispersion and generate higher revenue. We also find that the share of tax revenue from trade does not affect revenue performance significantly.

Finally, revenue performance does not appear to be determined significantly by corporate and individual tax rates, or by average tariffs, once we have taken into account the structural variables, institutional variables and various sources of tax revenue. As a result, we drop these variables from subsequent analysis.⁴

⁴ The baseline as well as the panel corrected standard error regressions (see below) included other explanatory variables that were not found to be significant and were hence dropped. These included structural variables such as share of manufacturing, export share, extent of monetization, degree of urbanization; institutional variables such as exchange rate stability and literacy; and policy variables such as standard VAT rates.

Table 2: Determinants of Revenue Performance (Fixed Effects Estimation)

	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)	(X)	(XI)	(XII)	(XIII)	(XIV)	(XV)	(XVI)		
Constant	-16.741 [1.09]	-24.405 [1.25]	-35.508 [1.49]	-2.97 [0.20]	-4.949 [0.16]	-7.93 [0.45]	2.013 [0.14]	-20.329 [0.58]	28.667* [5.30]	32.733* [4.00]	32.159* [3.41]	14.531* [5.56]	2.099 [0.52]	14.814* [7.31]	14.740* [5.70]	5.245 [1.01]		
Log PCGDP	4.544** [2.36]	5.169** [2.12]	6.519** [2.14]	2.179 [1.14]	1.112 [0.31]	2.358 [1.12]	1.565 [0.81]	3.156 [0.74]	-0.415+ [1.74]	-0.501+ [1.71]	-0.525+ [1.66]	-0.061 [1.01]	0.088 [0.71]	-0.159** [2.54]	-0.055 [0.90]	0.067 [0.71]		
Agri. share																		
Import share		0.063+ [1.92]	0.053+ [1.72]	0.035 [1.27]	0.156+ [2.02]	0.106* [2.70]	0.032 [1.09]	0.122+ [1.80]										
Aid share			0.076 [1.10]	0.113+ [2.00]	0.038 [0.32]	0.076 [1.24]	0.116** [2.19]	0.057 [0.52]										
Debt share			0.051 [0.63]	-0.082** [2.04]	-0.157 [1.16]	0.031 [0.45]	-0.077+ [1.82]	-0.150+ [1.81]										
Govt. stability				0.064 [0.68]	0.195 [1.53]													
Corruption				0.306 [0.93]	-0.157 [0.71]													
Law and order				0.041 [0.15]	0.045 [0.11]													
Political stability																		
Economic stability																		
Tax on G&S				-0.018 [0.54]	-0.014 [0.18]	-0.006 [0.25]	0.017 [0.61]	0.031 [1.30]						0	0.025 [1.02]	0.025 [0.83]		
Tax on IPC				0.045 [1.03]	0.218* [3.07]	0.102+ [1.64]	0.031 [0.72]	0.014 [0.23]						0.086 [1.30]	0.022 [0.50]	0.022 [0.33]		
Tax on trade				0.054 [0.99]	0.025 [0.37]		0.041 [0.65]	0.223* [0.61]										
Avg. tariff					-0.169+ [1.53]			-0.026 [0.10]										
Corporate tax					0.086 [0.84]			0.057 [0.61]										
Individual tax					-0.015 [0.61]			-0.009 [0.27]										
Observations	1875	1845	1637	387	71	1029	402	75	1824	1810	1658	378	69	1016	393	73		
Number of countries	105	104	94	51	32	72	53	34	103	102	94	51	31	71	53	33		
R-squared	0.018	0.028	0.041	0.083	0.445	0.094	0.07	0.481	0.048	0.054	0.062	0.09	0.469	0.115	0.075	0.477		

Note: Robust z statistics in brackets.

+ significant at 10%; **significant at 5%; *significant at 1%.

Table 3: Determinants of Revenue Performance (Random Effects Estimation)

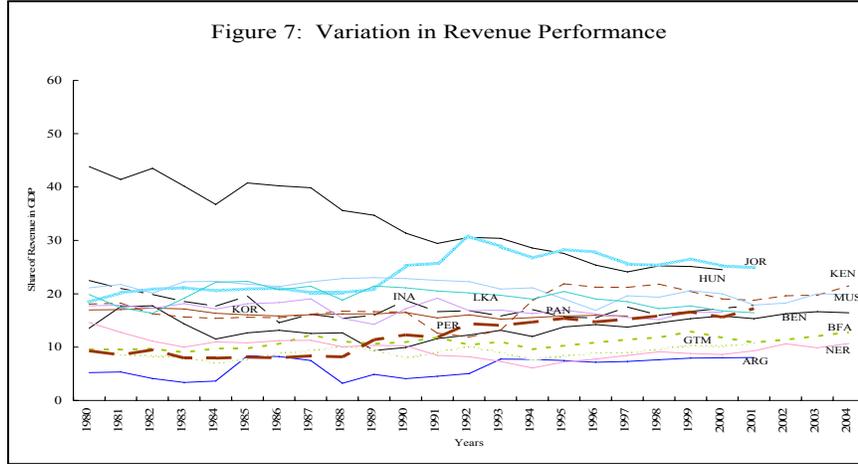
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)	(X)	(XI)	(XII)	(XIII)	(XIV)	(XV)	(XVI)	
Constant	-15.076 [1.44]	-17.174 [1.52]	-24.261+ [1.76]	-13.864 [1.42]	5.723 [0.56]	-12.181 [1.14]	-9.021 [0.97]	9.052 [0.94]	27.180* [8.86]	26.241* [6.05]	25.071* [4.87]	16.091* [5.81]	10.191* [2.98]	14.493* [5.93]	16.538* [5.75]	11.485** [2.41]	
Log PCGDP	4.228* [3.39]	4.017* [2.99]	4.756* [2.87]	3.480* [3.24]	0.633 [0.57]	2.725** [2.38]	2.957* [2.71]	0.257 [0.20]	-0.394** [2.28]	-0.401** [2.18]	-0.412** [1.98]	-0.138** [2.27]	-0.029 [0.34]	-0.183* [3.32]	-0.127** [2.11]	-0.056 [0.80]	
Agri. share																	
Import share		0.084* [2.90]	0.085* [3.07]	0.049** [2.02]	0.150* [2.92]	0.113* [3.10]	0.041 [1.61]	0.121* [2.76]	0.023 [0.69]	0.042 [1.16]	0.042 [1.16]	0.053+ [1.78]	0.159* [2.95]	0.091* [2.77]	0.044 [1.48]	0.122* [2.88]	
Aid share			0.068 [1.03]	0.091+ [1.74]	0.101 [0.95]	0.069 [1.14]	0.102** [2.05]	0.127 [1.23]			0.011 [0.12]	0.113** [2.08]	0.082 [0.87]	0.074 [1.26]	0.121** [2.27]	0.118 [1.29]	
Debt share			0.075 [0.97]	-0.06 [1.41]	-0.051 [0.48]	0.044 [0.66]	-0.062 [1.42]	-0.089 [1.10]			0.071 [0.79]	-0.067 [1.28]	-0.042 [0.39]	0.053 [0.78]	-0.069 [1.30]	-0.086 [1.10]	
Govt. stability				0.051 [0.55]	0.216 [1.41]						0.047 [0.52]	0.217 [1.37]					
Corruption				0.382 [1.17]	-0.154 [0.63]						0.35 [1.09]	-0.149 [0.65]					
Law and order				0.001 [0.01]	-0.257 [0.81]						0.07 [0.28]	-0.263 [0.75]					
Political stability																	
Economic stability																	
Tax on G&S				-0.041 [1.15]	-0.113* [3.02]	-0.009 [0.38]	0.016 [0.59]	0.044** [2.00]									
Tax on IPC				0.063 [1.53]	0.161* [2.86]	0.108+ [1.63]	0.035 [0.80]	0.008 [0.12]									
Tax on trade				0.036 [0.71]	-0.070+ [1.73]		0.018 [0.36]	-0.087** [2.07]									
Avg. tariff																	
Corporate tax																	
Individual tax																	
Observations	1,875	1,845	1,637	387	71	1,029	402	75	1,824	1,810	1,658	378	69	1,016	393	73	
Number of countries	105	104	94	51	32	72	53	34	103	102	94	51	31	71	53	33	

Note: Robust z statistics in brackets.

+ significant at 10%; **significant at 5%; *significant at 1%.

C. Panel-Corrected Standard Error Estimation

Most of the previous empirical analyses did not consider that revenue performance tends to be highly persistent over time (Leuthold (1991) is an exception). This persistence is illustrated in Figure 7 for a subset of the countries in our dataset.



In the presence of serial correlation, the empirical model becomes

$$y_{it} = \alpha + \beta.X_{it} + \gamma.Y_{it} + \delta.Z_{it} + u_i + \varepsilon_{it},$$

where

$$\varepsilon_{it} = \rho_i \cdot \varepsilon_{it-1} + v_{it}.$$

After testing for first-order serial correlation in the residuals with a Wooldridge test, we estimate the model using panel-corrected standard error estimates (PCSE).⁵ The PCSE uses Prais-Winsten regression, and assumes that the disturbances are heteroskedastic and contemporaneously correlated across panels. It can be used in the presence of an AR(1) with a common coefficient across all the panels ($\rho_i = \rho, \forall i$), and also with specific coefficient for each panel ($\rho_i \neq \rho_j, \forall i \neq j$). When autocorrelation with a common coefficient of correlation is specified, the common correlation coefficient is computed as

$$\rho = \frac{\rho_1 + \rho_2 + \rho_3 + \dots + \rho_m}{m},$$

In this expression, ρ_i is the estimated autocorrelation coefficient for panel i and m is the number of panels.

⁵ We used *xtserial* routine in Stata 9.1 to test for serial correlation. The null of no first order serial correlation is rejected at the 1 percent level across all specifications.

Although the PCSE estimates yields larger standard errors, the results are similar to the baseline results (see Tables 4 and 5). As before, revenue performance increases with per capita GDP and import share, and declines with agriculture share in GDP. The impact of foreign aid is now stronger, especially when the autocorrelation process is different for each panel. In this context, an anticipated increase in aid from around US\$80 billion in 2004 to US\$130 billion in 2010 would increase revenue performance by as much as 0.6 percent. Among the institutional factors, corruption has a significantly adverse effect on revenue performance (confirming the result by Ghura (1999)). Political and economic stability are significant only for some specifications, just like in the baseline estimations. We also confirm our earlier findings that revenue performance in countries with heavy reliance on taxes from goods and services is weaker, it is better for those countries that rely more on taxes from income, profits and capital gains. Finally, relatively high reliance on tax revenue from trade remains associated with poor revenue performance, but this finding is not robust across specifications.

D. Sensitivity Analysis

Testing for Endogeneity

Countries that find it difficult to mobilize revenue from domestic sources would be expected to rely more heavily on foreign aid and debt as a source of revenue. Therefore, there can be an endogeneity problem among foreign aid, debt and revenue performance.

To allow for this endogeneity, we re-estimate the specifications presented in columns III-VI and IX-XII of Tables 4 and 5 with lagged values of aid share and debt share, instead of contemporaneous values. The results are given in Table 6.

It appears that endogeneity is not a severe problem, because the findings in Table 6 remain similar to the earlier results. While debt continues to be weakly related to revenue performance, foreign aid has a positive and significant impact on revenue performance (particularly for the case where countries have different degrees of persistence in revenue performance). We also see that the sources of tax revenue are strong determinants of revenue performance, since the coefficient on the share of taxes from goods and services, as well as that from income, profits and capital gains are significant across all specifications.

Table 4: Determinants of Revenue Performance (Common Correlation Coefficient)

	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)	(X)	(XI)	(XII)
Constant	-4.9 [0.99]	-5.996 [1.45]	-10.279** [2.08]	-8.269 [1.30]	-12.568* [3.14]	-7.28 [1.24]	26.170* [27.03]	23.818* [17.02]	22.735* [18.68]	17.201* [8.62]	15.784* [8.53]	16.988* [7.26]
Log PCGDP	3.065* [5.32]	2.692* [5.40]	3.120* [5.14]	2.650* [3.87]	2.814* [5.39]	2.401* [3.45]						
Agri. share							-0.313* [7.07]	-0.315* [7.51]	-0.335* [7.86]	-0.210* [4.69]	-0.225* [7.30]	-0.197* [4.47]
Import share		0.092* [6.75]	0.099* [6.32]	0.108* [5.64]	0.129* [6.67]	0.103* [5.40]		0.052* [2.66]	0.080* [5.14]	0.089* [4.72]	0.112* [6.49]	0.088* [4.74]
Aid share			0.021 [0.65]	0.044 [1.05]	0.005 [0.28]	0.078+ [1.77]		0.036 [1.48]	0.036 [1.48]	0.055 [1.40]	0.024 [1.08]	0.088** [2.09]
Debt share			-0.003 [0.09]	-0.054 [1.36]	0.001 [0.02]	-0.077+ [1.93]		-0.028 [1.09]	-0.028 [1.09]	-0.057+ [1.87]	-0.013 [0.52]	-0.084** [2.52]
Govt. stability				0.019 [0.20]						-0.003 [0.04]		
Corruption				0.695** [2.29]						0.650** [2.18]		
Law and order				0.084 [0.50]						0.245 [1.50]		
Political stability					0.018 [0.75]	0.060+ [1.91]					0.011 [0.45]	0.053+ [1.81]
Economic stability					0.063+ [1.70]	0.017 [0.41]					0.052 [1.41]	0.007 [0.14]
Tax on G&S				-0.116* [3.67]		-0.125* [4.14]				-0.105* [3.50]		-0.122* [4.18]
Tax on IPC				0.149* [4.68]		0.148* [5.20]				0.136* [5.08]		0.136* [5.54]
Tax on trade				-0.050+ [1.73]		-0.048+ [1.74]				-0.044 [1.46]		-0.041 [1.39]
Observations	1,875	1,845	1,637	387	1,029	402	1,824	1,810	1,658	378	1,016	393
Number of countries	105	104	94	51	72	53	103	102	94	51	71	53

Note: Robust z statistics in brackets.
+ significant at 10%; **significant at 5%; * significant at 1%.

Table 5: Determinants of Revenue Performance (Panel Specific Correlation Coefficient)

	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)	(X)	(XI)	(XII)
Constant	-13.699* [2.91]	-18.533* [4.03]	-17.326* [4.21]	-17.288* [3.03]	-19.416* [6.18]	-22.642* [4.41]	30.308* [21.69]	26.217* [15.47]	23.969* [17.09]	18.108* [13.70]	17.558* [9.88]	16.873* [7.36]
Log PCGDP	4.425* [8.14]	4.260* [7.70]	3.887* [7.09]	3.815* [5.98]	3.521* [8.93]	4.177* [6.82]	-0.362* [8.11]	-0.351* [8.59]	-0.353* [8.89]	-0.191* [5.07]	-0.286* [9.35]	-0.203* [5.61]
Agri. share												
Import share		0.119* [7.64]	0.119* [7.38]	0.105* [5.12]	0.136* [7.08]	0.098* [5.43]		0.076* [3.51]	0.092* [6.45]	0.122* [7.66]	0.128* [7.77]	0.103* [6.18]
Aid share			0.044+ [1.63]	0.081** [2.37]	0.031+ [1.93]	0.094* [3.20]			0.068** [2.34]	0.055 [1.64]	0.052** [2.28]	0.096* [2.91]
Debt share			0.024 [0.65]	-0.04 [1.03]	0.039 [1.05]	-0.047 [1.23]			-0.037 [1.16]	-0.054 [1.57]	0.01 [0.33]	-0.078** [2.09]
Govt. stability				-0.008 [0.11]						-0.106 [1.18]		
Corruption				0.288+ [1.67]						0.665* [2.70]		
Law and order				-0.031 [0.20]						0.078 [0.44]		
Political stability					0.02 [0.90]	0.026 [1.11]					0.003 [0.14]	0.044 [1.57]
Economic stability					0.088** [2.22]	0.035 [1.17]					0.056 [1.42]	0.026 [0.76]
Tax on G&S				-0.101* [3.79]		-0.094* [3.71]				-0.130* [4.47]		-0.131* [4.12]
Tax on IPC				0.152* [6.35]		0.151* [6.66]				0.134* [5.88]		0.143* [7.31]
Tax on trade				0.009 [0.29]		0.018 [0.59]				-0.033 [1.07]		-0.021 [0.72]
Observations	1,875	1,845	1,637	387	1,029	402	1,824	1,810	1,658	378	1,016	393
Number of countries	105	104	94	51	72	53	103	102	94	51	71	53

Note: Robust z statistics in brackets.
significant at 10%, **significant at 5%, *significant at 1%.

Table 6: Determinants of Revenue Performance (Lagged Values of Foreign Aid and Debt)

	Common Correlation Coefficient										Panel Specific Correlation Coefficient									
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)	(X)	(XI)	(XII)	(XIII)	(XIV)	(XV)	(XVI)				
Constant	-14.697* [4.02]	-8.454 [1.49]	-12.806* [3.24]	-6.721 [1.25]	21.044* [21.61]	17.191* [8.56]	15.906* [8.61]	17.049* [7.49]	-23.158* [6.68]	-16.701* [2.86]	-18.568* [5.60]	-22.012* [3.89]	22.502* [24.27]	18.071* [15.43]	17.310* [9.32]	17.539* [9.14]				
Log PCGDP	3.614* [7.75]	2.653* [4.31]	2.835* [5.48]	2.357* [3.58]					4.581* [9.64]	3.767* [5.65]	3.372* [7.91]	4.165* [6.14]								
Agri. share					-0.273* [7.95]	-0.213* [4.61]	-0.228* [7.59]	-0.202* [4.39]					-0.335* [9.61]	-0.191* [4.93]	-0.287* [8.98]	-0.199* [5.44]				
Import share	0.094* [6.34]	0.098* [5.19]	0.120* [5.83]	0.092* [4.85]	0.078* [5.80]	0.080* [4.38]	0.099* [5.47]	0.077* [4.41]	0.113* [7.42]	0.093* [4.99]	0.133* [6.68]	0.086* [5.11]	0.094* [6.94]	0.113* [7.20]	0.116* [6.42]	0.094* [5.95]				
Aid share	0.034** [2.10]	0.035 [1.08]	0.024 [1.25]	0.063+ [1.80]	0.017 [1.13]	0.059+ [1.77]	0.047** [2.49]	0.089** [2.48]	0.043* [2.64]	0.063* [2.59]	0.028+ [1.70]	0.071* [3.11]	0.033+ [1.79]	0.049+ [1.66]	0.067* [3.01]	0.075* [2.72]				
Debt share	0.034 [1.41]	0.035 [0.95]	0.045 [1.59]	0.017 [0.47]	0.040+ [1.81]	0.015 [0.48]	0.029 [1.20]	0 [0.01]	0.05 [1.60]	0.027 [0.80]	0.073+ [1.93]	0.019 [0.57]	0.033 [1.21]	0.026 [0.83]	0.035 [1.20]	0.008 [0.28]				
Govt. stability		0.031 [0.34]				0.011 [0.12]				0.021 [0.27]			-0.063 [0.74]							
Corruption		0.744** [2.38]				0.694** [2.30]				0.286 [1.16]			0.673* [2.58]							
Law and order		0.049 [0.29]				0.185 [1.08]				-0.074 [0.43]			0.034 [0.19]							
Political stability			0.018 [0.75]	0.059+ [1.88]			0.01 [0.44]	0.052+ [1.74]		0.022 [1.05]	0.033 [1.39]			0.005 [0.24]	0.042+ [1.65]					
Economic stability			0.059+ [1.66]	0.014 [0.34]			0.049 [1.36]	0.009 [0.19]		0.087** [2.20]	0.018 [0.59]			0.064 [1.63]	0.005 [0.14]					
Tax on G&S		-0.117* [3.51]		-0.125* [3.84]		-0.105* [3.26]	-0.123* [3.92]			-0.105* [3.64]	-0.099* [3.69]		-0.126* [4.32]		-0.122* [3.80]					
Tax on IPC		0.138* [4.22]		0.136* [4.69]		0.124* [4.40]	0.126* [5.04]			0.141* [6.23]	0.134* [6.18]		0.115* [5.48]		0.125* [8.46]					
Tax on trade		-0.047 [1.57]		-0.046 [1.61]		-0.042 [1.37]	-0.038 [1.27]			0.011 [0.37]	0.032 [1.06]		-0.031 [1.22]		-0.016 [0.64]					
Observations	1,562	385	1,021	400	1,584	376	1,010	391	1,562	385	1,021	400	1,584	376	1,010	391				
Number of countries	94	51	72	53	94	51	71	53	94	51	72	53	94	51	71	53				

Note: Robust z statistics in brackets.
significant at 10%. **significant at 5%; *significant at 1%.

Dynamic Panel Data

Instead of allowing for serial correlation in the error term, the econometric specification could also capture the persistence in revenue performance (described in Section IV.C) by including the lagged value of the dependent variable. Because the lagged dependent variable is correlated with the error term, it is well known that this creates some estimation problems. To overcome these problems, Arellano and Bond (1991) proposed a generalized method-of-moments estimator using lagged levels of the dependent variable and the predetermined variables and differences of strictly exogenous variables. This method is referred to as *difference-GMM*. A problem with the original Arellano-Bond estimator is that lagged levels of variables may be poor instruments if those variables are highly persistent. In such cases, Arellano and Bover (1995) and Blundell and Bond (1998) describe how additional moment conditions can increase efficiency. This procedure is referred to as *system-GMM*.

Table 7 reports the results from the dynamic panel methods.⁶ Our results confirm that lagged revenue share is a strong and significant predictor of current revenue performance, across both difference- and system-GMM. Overall, the results from the difference-GMM are quite weak, and only agriculture share, aid share and debt share are significant predictors of revenue performance. However, once we use system-GMM to take into account the near random walk of revenue performance, the results are broadly similar to the baseline results.

Looking at columns (V) to (VIII) in Table 7 we find that per capita GDP, agriculture share and import share are significant predictor of revenue performance. However, the impact of per capita GDP is substantially smaller in the dynamic specification. The impact of agriculture share and import share are also marginally smaller in the dynamic specification. Both foreign aid share and debt share significantly affect the revenue performance. While aid share has a positive impact, a higher debt share is associated with a lower revenue performance. Finally, as in the baseline specification, share of revenue from taxing goods and services is negatively related to revenue performance, while share of revenue from income, profit and capital gains has a positive impact.

⁶ The difference GMM estimations used the `xtabond` routine in Stata 9.1, and the system GMM estimations used the `xtabond2` routine. The share of aid and the share of debt were considered to be endogenous variables.

Table 7: Determinants of Revenue Performance (Dynamic Panel Specification)

	Difference GMM				System GMM			
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
Constant	-0.068 [0.98]	-0.063 [0.86]	-0.051 [0.68]	-0.035 [0.47]	-5.349** [2.11]	-5.051** [1.99]	9.038* [3.44]	6.126* [2.96]
Revenue share (Lag)	0.361* [4.98]	0.325* [4.22]	0.361* [5.09]	0.337* [4.30]	0.815* [12.71]	0.795* [11.10]	0.714* [7.15]	0.721* [7.33]
Log PCGDP	1.901 [0.93]	-0.071 [0.03]			0.927* [2.67]	0.786** [2.31]		
Agri. share			-0.110+ [1.79]	-0.103+ [1.72]			-0.137* [3.53]	-0.101* [3.30]
Import share	0.052 [1.44]	0.051 [1.32]	0.046 [1.16]	0.047 [1.14]	0.036** [2.43]	0.038** [2.41]	0.038+ [1.81]	0.038** [2.10]
Aid share	0.096** [2.08]	0.098** [2.27]	0.113** [2.50]	0.109** [2.46]	0.072+ [1.93]	0.074+ [1.82]	0.104* [2.94]	0.078** [2.04]
Debt share	-0.098* [3.21]	-0.093* [2.81]	-0.103* [2.95]	-0.100** [2.57]	-0.117** [2.25]	-0.125* [2.64]	-0.160* [2.93]	-0.138* [2.85]
Govt. stability	0.052 [0.62]		0.042 [0.53]		0.108 [1.39]		-0.065 [0.57]	
Corruption	0.445 [1.60]		0.438 [1.49]		0.062 [0.33]		-0.518 [1.37]	
Law and order	-0.25 [0.96]		-0.212 [0.79]		-0.218 [1.59]		0.065 [0.30]	
Political stability		0.007 [0.27]		0.004 [0.16]		0.019 [1.08]		0.009 [0.48]
Economic stability		0.016 [0.38]		-0.009 [0.20]		0.006 [0.17]		-0.006 [0.16]
Tax on G&S	0.021 [0.69]	0.016 [0.53]	0.022 [0.74]	0.008 [0.28]	-0.032+ [1.63]	-0.032+ [1.78]	-0.044+ [1.79]	-0.047** [2.00]
Tax on IPC	0.028 [0.51]	0.053 [1.20]	0.025 [0.47]	0.041 [0.97]	0.044** [2.02]	0.050** [2.27]	0.052+ [1.96]	0.049** [2.07]
Observations	322	335	313	326	376	391	367	382
Number of countries	50	52	50	52	51	53	51	53

Note: Robust z statistics in brackets.

significant at 10%; ** significant at 5%; *significant at 1%.

All variables are in difference.

Second-order autocorrelations of residual are always rejected.

Aid share and Debt share are treated as endogenous variables because they can be influenced by revenue performance.

Sub Sample Analysis

Next, we look closer at the revenue performance of countries that belong to similar income groups. To proceed, we split the sample according to the World Bank's classification of countries according to income group (see Appendix B for the list of countries by income group). The estimation results are given in Tables 8-10. Several interesting findings emerge.

We find that the share of agriculture in GDP is a significant determinant of revenue performance across all income ranges. On the other hand, while per capita GDP has a strong impact on revenue mobilization in high-income countries, its effect is somewhat weaker in low-income and middle-income countries. For the low- and middle-income countries we also find a strong and positive relationship impact from openness to trade; this relationship is not always significant for high-income countries.

For low-income countries, foreign aid has a significant positive effect on revenue performance across most specifications. For these countries, an increase in foreign aid by 1 percent can improve revenue performance by as much as 0.11 percent. This relationship is not statistically significant for middle-income and high-income countries. There is no significant relationship between foreign debt and revenue performance in any of the groups.

Among institutional factors, the coefficient on corruption is significant for low-income and middle-income countries. Indeed, for these countries, a reduction in corruption (implying an increase in the corruption index) would substantially increase revenue. For example, in low-income countries, an increase in the corruption index of one unit would improve revenue performance by about 1.5 percent; and in middle-income countries, the effect is slightly greater than 0.5 percent. On the other hand, the coefficients on government stability and law and order are not statistically significant in any of the groups.

Next, the results suggest that political stability is weakly related to revenue performance for low- and middle income countries but not for high-income countries. For low-income countries, an increase in the political stability index of one unit can increase revenue performance by 0.08 percent; for middle-income countries the effect would be 0.07 percent. However, political stability has a weak negative relationship in high-income countries. Also, economic stability has a weak impact on revenue performance, and only in low-income countries.

Finally, we find that in low-income and high-income countries, but not in the middle-income group, greater reliance on taxing goods and services as a source of revenue is associated with poor revenue performance. Furthermore, greater reliance on taxing income, profits and capital gains is associated with improved revenue performance across all income groups.

Table 8: Determinants of Revenue Performance (Low-Income Countries)

	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)	(X)	(XI)	(XII)
Constant	-15.452** [2.00]	-7.226 [0.64]	-8.258 [0.92]	-0.935 [0.12]	-22.196* [4.02]	-14.714** [2.17]	33.650* [15.51]	27.907* [10.82]	30.128* [12.64]	17.531* [6.16]	19.410* [8.98]	15.528* [4.45]
Log PCGDP	4.781* [5.14]	2.946** [2.05]	2.922** [2.37]	1.597 [1.34]	4.102* [5.84]	2.693** [2.45]	-0.398* [7.11]	-0.358* [6.06]	-0.432* [7.59]	-0.204* [6.24]	-0.328* [8.80]	-0.211* [5.86]
Agri. share												
Import share		0.102* [5.38]	0.115* [5.02]	0.172* [5.23]	0.176* [5.72]	0.111* [3.60]		0.078* [3.75]	0.057* [2.90]	0.131* [4.93]	0.123* [5.42]	0.100* [3.69]
Aid share			-0.001 [0.02]	0.006 [0.12]	-0.024 [1.07]	0.115** [2.54]			0.067** [2.07]	0.038+ [1.84]	0.045+ [1.73]	0.114* [2.88]
Debt share			0.120** [2.38]	-0.016 [0.33]	0.091 [1.54]	-0.081 [1.53]			-0.024 [0.56]	-0.052 [1.28]	0.016 [0.45]	-0.098** [2.20]
Govt. stability				-0.142 [1.17]						-0.164 [1.49]		
Corruption				1.469* [3.23]						1.004** [2.44]		
Law and order				-0.342 [1.10]						-0.093 [0.34]		
Political stability					0.016 [0.48]	0.083* [2.67]					0.005 [0.18]	0.043+ [1.65]
Economic stability					0.102** [2.01]	0.033 [0.82]					0.081+ [1.63]	0.055 [1.26]
Tax on G&S				-0.107** [2.35]		-0.106** [2.30]				-0.125* [3.29]		-0.135* [3.66]
Tax on IPC				0.168* [5.03]		0.226* [4.88]				0.152* [4.93]		0.177* [4.48]
Tax on trade				-0.031 [0.74]		0.003 [0.08]				-0.019 [0.53]		-0.024 [0.83]
Observations	889	882	835	136	516	136	888	882	841	136	512	136
Number of countries	44	44	42	19	32	19	43	43	41	19	31	19

Note: Robust z statistics in brackets.
significant at 10%, **significant at 5%, *significant at 1%.

Table 9: Determinants of Revenue Performance (Middle-Income Countries)

	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)	(X)	(XI)	(XII)
Constant	0.846 [0.06]	-0.859 [0.07]	0.114 [0.01]	-18.177 [1.38]	5.542 [0.45]	-21.316** [2.06]	22.684* [15.62]	15.538* [10.99]	14.602* [12.12]	12.157* [4.50]	11.128* [5.54]	12.527* [3.93]
Log PCGDP	2.22 [1.38]	1.616 [1.18]	1.455+ [1.60]	3.370** [2.19]	0.404 [0.27]	3.789* [2.99]	-0.150** [2.53]	-0.130* [2.70]	-0.106** [2.14]	-0.052 [0.96]	-0.078 [1.44]	-0.109+ [1.92]
Agri. share												
Import share		0.177* [9.20]	0.166* [10.46]	0.169* [6.24]	0.149* [7.49]	0.181* [7.56]	0.170* [9.22]	0.167* [10.85]	0.167* [10.85]	0.172* [6.53]	0.144* [7.35]	0.169* [7.89]
Aid share			0.085 [1.14]	0.036 [0.29]	-0.049 [0.63]	0.019 [0.16]		0.065 [0.92]	0.065 [0.92]	0.015 [0.13]	-0.036 [0.54]	0.089 [0.78]
Debt share			-0.046 [0.82]	0.028 [0.29]	0.021 [0.33]	0.029 [0.37]		-0.068 [1.22]	-0.068 [1.22]	-0.033 [0.33]	-0.002 [0.03]	-0.043 [0.50]
Govt. stability				0.071 [0.60]						0.036 [0.32]		
Corruption				0.441+ [1.84]						0.554** [2.23]		
Law and order				-0.22 [0.95]						-0.145 [0.57]		
Political stability					0.070* [2.88]	0.048 [1.41]					0.070* [3.17]	0.071** [2.05]
Economic stability					-0.027 [0.64]	-0.061 [1.24]					-0.039 [0.93]	-0.081 [1.60]
Tax on G&S				-0.032 [0.88]		-0.023 [0.71]				-0.032 [0.90]		-0.022 [0.68]
Tax on IPC				0.109+ [1.89]		0.099+ [1.92]				0.089+ [1.60]		0.08+ [1.63]
Tax on trade				-0.03 [0.52]		-0.068 [1.20]				-0.104** [2.03]		-0.107** [2.21]
Observations	507	507	465	180	316	183	507	507	465	180	316	183
Number of countries	31	31	30	20	24	21	31	31	30	20	24	21

Note: Robust z statistics in brackets.

+ significant at 10%, **significant at 5%, *significant at 1%.

Table 10: Determinants of Revenue Performance (High-Income Countries)

	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)	(X)	(XI)	(XII)
Constant	-10.348 [0.76]	-12.575 [0.91]	-8.202 [0.66]	-27.003 [0.91]	-113.269* [6.18]	-63.548** [2.50]	30.703* [18.38]	34.220* [10.80]	27.199* [14.15]	27.322* [6.68]	35.535* [6.27]	30.044* [4.81]
Log PCGDP	3.900** [2.52]	4.045* [2.71]	3.316** [2.37]	5.460+ [1.67]	15.716* [7.25]	9.923* [3.33]	-0.402* [3.89]	-0.391* [3.28]	-0.468* [4.47]	-0.534+ [1.68]	-0.836* [5.49]	-0.730* [3.28]
Agri. share												
Import share	0.009 [0.34]	0.009 [0.34]	0.052** [2.46]	-0.009 [0.40]	0.032 [1.43]	-0.029 [1.59]		-0.09 [1.46]	0.055** [2.23]	-0.045* [2.62]	-0.039 [1.19]	-0.069* [3.98]
Aid share			-0.028 [0.36]	0.247 [0.42]	0.45 [1.37]	0.761 [1.11]			0.069 [0.64]	0.494 [0.82]	0.570+ [1.79]	0.904 [1.47]
Debt share			0.013 [0.26]	0.088 [1.22]	-0.055 [0.83]	0.083 [1.30]		0.003 [0.05]	0.003 [0.05]	0.144+ [1.77]	0.128 [1.48]	0.274* [3.42]
Govt. stability				-0.516* [2.70]						-0.274 [1.29]		
Corruption				0.992 [1.29]						0.756 [0.93]		
Law and order				0.625 [0.81]						1.279 [1.56]		
Political stability					-0.181* [3.27]	-0.124 [1.56]					-0.137* [2.61]	0.033 [0.71]
Economic stability					0.12 [1.41]	0.085 [0.74]					0.041 [0.48]	-0.013 [0.09]
Tax on G&S				-0.203* [4.11]		-0.093** [2.30]				-0.276* [6.22]		-0.210* [4.21]
Tax on IPC				0.157+ [1.86]		0.215* [4.70]				0.039 [0.43]		0.05 [1.04]
Tax on trade				-0.278 [1.43]		-0.206 [1.34]				-0.221 [1.18]		-0.186 [1.34]
Observations	479	456	337	71	197	83	429	421	352	62	188	74
Number of countries	30	29	22	12	16	13	29	28	23	12	16	13

Note: Robust z statistics in brackets.
+ significant at 10%; ** significant at 5%; * significant at 1%.

Using various forms of panel data estimations, and correcting for the observed persistence in revenue performance, our results confirm that the principal determinants of revenue performance include factors like per capita GDP, agriculture's share in GDP, trade openness, foreign aid, corruption, political stability and specific sources of tax revenue. Although the results are broadly similar across most specifications, we prefer the results from the panel-corrected standard error estimates with panel specific correlation coefficient and system-GMM estimates.

V. ASSESSMENT OF REVENUE PERFORMANCE

So far our analysis has focused on finding the main factors that affect revenue performance in a sample of developing countries. However, as pointed out by Chelliah (1971) and Chelliah et. al. (1975), this does not tell us whether a country *could not*, if it wanted, attain higher revenue performance. Countries inherently have different capacities to raise revenues, and this must be taken into consideration while making cross-country revenue comparisons. We follow these studies and compute the revenue effort for the countries in our sample.

Our starting point is to take the estimated coefficients of the regressions in the previous section to compute the 'predicted' revenue performance of the countries in the sample. Next, we use this predicted revenue performance to construct an index of revenue effort by taking the ratio of the actual revenue performance and the predicted values. Thus, a country that lies on the regression line will have a revenue performance index equal to 1, and countries that have actual revenue performance above (below) predicted revenue performance have a revenue effort index bigger than (smaller than) one.

Of course this approach has a number of limitations. First, there might be some unobserved variables that affect revenue performance. Second, while calculating the tax potential we must focus only on factors, which are 'given' i.e., beyond the control of the government. Finally, the revenue effort index will not be robust to the regression specification. Therefore, in deciding which equation to use, one needs to consider the statistical fit as well as the economic rationale. Aware of these qualifications, we proceed and we present the revenue effort indices in Table 11.⁷

When we include per capita GDP as one of the explanatory factors, 43 countries perform better than predicted (when agriculture share is included instead, the number drops

⁷ To calculate these indices, we used the specifications in column (III) and (IX) of Table 5. These specifications include per capita GDP, trade openness, agriculture share, aid and debt share, and dummies for being resource rich and landlocked.

marginally to 42).⁸ We can see from Table 11 that a number of Sub-Saharan African countries have exhibited remarkable revenue performance compared to other countries, most notably those in Latin America. Sub-Saharan African countries that have a revenue effort index greater than 1.5 include Burundi, Botswana, Malawi, and Zimbabwe. These countries have probably largely used their tax potential as they are constrained by low per capita GDP, a dominant agriculture sector and limited degree of openness to trade. On the other hand, countries like Argentina, Brazil, Peru, Panama, United Arab Emirates etc. have revenue performance indices well below 0.75, which suggests that they have yet to achieve their full revenue potential.

Using our finding that countries at different stages of development exhibit significantly different relationships between economic variables and revenue performance, we create revenue performance indices separately for low-income, middle-income and high-income developing countries. We again use the specifications outlined in column (III) and (IX) of Tables 8-10; the results of this exercise are in Table 12. We notice that among low-income countries, the performance of Sub-Saharan African countries is quite varied. For example, countries like Zimbabwe, Zambia, Burundi and Ethiopia performed distinctly better than predicted. On the other hand, countries like Chad and Madagascar fell short of their revenue potential. Also, some countries show different tax performance depending on the specification. For example, if we consider the specification that includes GDP per capita, then countries like Niger, Guinea-Bissau and Togo perform relatively poorly; however, if we take into account the presence of a large agriculture sector (more than 40 percent), then these same countries perform better than predicted. Among the middle-income group, countries such as Egypt, Tunisia, Morocco and Algeria perform well given their economic structure. The below-average performers are mainly some Latin American countries like Colombia, El Salvador and Guatemala, as well as some countries from the former Soviet Union, like Georgia and Kazakhstan. Finally, among high-income countries, resource-rich countries like Kuwait, Botswana and Oman have performed close to their revenue potential. Countries that have failed to realize their revenue potential include countries from Latin America and Eastern Europe like Argentina, Costa Rica, Latvia, Lithuania and the Slovak Republic.

⁸ Indeed, the revenue performance index yields largely similar results irrespective of the use of per capita GDP or agriculture share as an explanatory variable in its construction. A simple correlation between the values of the indices based on the two specifications yields a R^2 equal to 0.76. Moreover, for most countries, the difference between the two indices is less than 0.3, and less than 0.1 in many.

Table 11: Revenue Effort Indices for Developing Countries (1980–2004)

Country	Per Capita GDP		Agriculture Share		Country	Per Capita GDP		Agriculture Share	
	Index No.	Rank	Index No.	Rank		Index No.	Rank	Index No.	Rank
Albania	0.86	63	1.06	34	Kazakhstan	0.48	98	0.48	98
Algeria	1.44	13	1.28	13	Kenya	1.28	18	1.02	38
Angola	1.61	3	1.3	12	Korea, Rep.	0.73	82	0.64	84
Argentina	0.31	102	0.28	101	Kuwait	1.44	12	1.31	11
Bahrain	0.92	54	0.85	61	Kyrgyz Republic	0.93	51	1.31	10
Bangladesh	0.87	61	0.69	81	Latvia	0.63	89	0.57	93
Belarus	0.82	71	0.86	59	Lesotho	1.25	21	1.28	14
Belize	1	42	0.99	44	Lithuania	0.63	90	0.61	87
Benin	1.05	41	0.91	51	Macao, China	0.65	87		
Bolivia	0.8	75	0.71	80	Madagascar	0.92	53	0.72	79
Botswana	1.69	1	1.6	3	Malawi	1.5	9	1.55	5
Brazil	0.71	83	0.59	91	Mali	0.76	78	1	42
Bulgaria	1.07	37	1.05	36	Malta	1.19	27	1.15	23
Burkina Faso	0.84	68	0.78	72	Mauritius	0.86	64	0.81	65
Burundi	1.51	8	3.24	1	Moldova	0.93	52	1.06	35
Cameroon	0.84	66	0.91	52	Mongolia	0.88	59	1.11	29
Cape Verde	1.4	14	1.19	20	Morocco	1.34	15	1.13	26
Central African Republic	0.58	93	1	41	Mozambique	0.97	46	0.77	73
Chad	0.41	100	0.47	99	Namibia	1.26	20	1.2	19
China	0.4	101	0.32	100	Nicaragua	0.79	76	0.77	77
Colombia	0.57	95	0.52	96	Niger	0.77	77	0.89	53
Comoros	0.89	57	1	40	Nigeria	1	43	0.87	57
Congo, Dem. Rep.	0.45	99	0.62	86	Oman	1.34	16	1.19	21
Congo, Rep.	1.49	10	0.92	50	Panama	0.68	85	0.6	88
Costa Rica	0.6	92	0.6	89	Papua New Guinea	1.22	23	1.25	16
Cote d'Ivoire	1.2	25	1.13	27	Paraguay	0.61	91	0.77	76
Croatia	1.07	38	1.02	37	Peru	0.75	79	0.6	90
Cyprus	0.71	84	0.68	82	Philippines	0.8	74	0.77	75
Czech Republic	1.05	40	1.01	39	Poland	1.14	31	0.97	48
Dominican Republic	0.66	86	0.59	92	Rwanda	0.84	67	1.1	30
Egypt, Arab Rep.	1.57	4	1.33	9	Principe			0.88	55
El Salvador	0.58	94	0.53	95	Senegal	1.11	32	0.82	64
Equatorial Guinea	0.96	49	1.4	8	Seychelles			1.58	4
Ethiopia	1.69	2	3.15	2	Sierra Leone	0.81	73	0.79	70
Fiji	1.1	33	1.09	32	Slovak Republic	0.84	69	0.86	60
Gabon	1.22	24	1.09	31	Slovenia	0.84	70	0.81	66
Gambia, The	0.98	44	0.97	47	Solomon Islands	1.09	35		
Georgia	0.52	96	0.57	94	South Africa	0.94	50	0.84	63
Ghana	0.73	81	0.97	46	Sri Lanka	1.05	39	0.99	45
Grenada	1.08	36	0.99	43	St. Kitts and Nevis	0.91	56	0.84	62
Guatemala	0.52	97	0.51	97	St. Lucia	0.97	47	0.87	58
Guinea	0.87	60	0.77	74	St. Vin & the Gren	1.16	28	1.09	33
Guinea-Bissau	1.14	29	1.51	6	Swaziland	1.1	34	1.18	22
Haiti	0.64	88	0.63	85	Tanzania	0.86	62	0.89	54
Honduras	0.75	80	0.65	83	Togo	1.14	30	1.2	18
Hungary	1.33	17	1.27	15	Trinidad and Tobago	1.47	11	1.22	17
Indonesia	0.91	55	0.8	68	Tunisia	1.27	19	1.14	25
Iran, Islamic Rep.	0.88	58	0.87	56	Ukraine	0.82	72	0.78	71
Israel	1.54	6			United Arab Emirates	0.07	103	0.07	102
Jamaica	1.23	22	0.97	49	Uruguay	0.85	65	0.76	78
Jordan	0.98	45	0.8	69	Venezuela, RB	0.96	48	0.8	67

Author's Calculations.

Table 12: Revenue Performance Index (Income Based Classification) (concluded)

	Low-Income Countries		Middle-Income Countries		High-Income Countries	
	Per Capita GDP Index No.	Agriculture Share Rank	Per Capita GDP Index No.	Agriculture Share Rank	Per Capita GDP Index No.	Agriculture Share Rank
Malta	0.82	11	Russian Federation	32	St. Vin. and the Gren.	8
Moldova	0.82	12	Samoa	33	Trinidad and Tobago	3
Mongolia	0.82	12	South Africa	1.1	United Arab Emirates	0.06
Mozambique	0.55	33	Sri Lanka	1.05	Uruguay	0.55
Nicaragua	0.54	34	Swaziland	1.15	Venezuela, RB	0.71
Niger	0.64	26	Tunisia	1.35		1.16
Nigeria	0.64	25	Turkey	34		0.07
Papua New Guinea	0.78	15	Ukraine	0.88		0.71
Rwanda	0.76	17	Vanuatu	35		0.82
São Tomé and Príncipe						
Senegal	0.67	23				
Sierra Leone	0.43	40				
Solomon Islands	0.77	16				
Tanzania	0.56	32				
Togo	0.72	20				
Vietnam	0.75	18				
Zambia	1.26	5				
Zimbabwe	1.38	1				

VI. POLICY RECOMMENDATIONS AND CONCLUSIONS

Our primary objective was to investigate revenue performance of a large set of developing countries over the past 25 years. We found that several structural factors like per capita GDP, share of agriculture in GDP and trade openness are statistically significant and strong determinants of revenue performance. We also looked at the impact of foreign aid and foreign debt on revenue mobilization. Our results indicate that although foreign aid improves revenue performance significantly, debt does not. Among the institutional factors, we found corruption has a significantly negative effect on revenue performance. Political and economic stability also affect revenue performance, but only across certain specifications. Finally, we found that countries that depend on taxing goods and services as their primary source of tax revenue, tend to have poorer revenue performance. On the other hand, countries that put greater emphasis on taxing income, profits and capital gains, perform better. These results are robust to a varied set of specifications.

We continued the analysis by dividing the sample of countries based on income groups. Doing so, we found that the structural factors continue to be significant across all income groups, but foreign aid has a significant and positive effect only for the group of low-income countries. Corruption remains important for low-income and middle-income countries, but not for high-income countries. Also, a politically stable regime helps generate higher revenue for low-income countries. And while the share of taxes on income, profit and capital gains in revenue is positively associated with revenue performance across all groups, that of taxes on goods and services is negatively associated with revenue performance in low-income and high-income countries.

Finally, we calculated the revenue performance indices by comparing actual revenue performance with the predicted revenue performance. We found that several African countries, including from Sub-Saharan Africa like Burundi, Ethiopia, Guinea-Bissau and Zimbabwe perform significantly better than predicted. On the other hand, many countries from Latin America and Eastern Europe fall well short of their revenue potential.

Our results suggest several policy recommendations. The positive impact of foreign aid on revenue performance, especially for low-income countries, recommends increased aid to these countries. In this context, the rich donor countries' pledge, "*to make concrete efforts towards the target of 0.7 percent of their GNP in international aid*", could be a step in the right direction⁹. As pointed out by Gupta et al. (2004), donor countries should monitor the aid flow and ensure that it is used for poverty reduction and infrastructure development, which would generate higher revenue in the future.

A reduction in corruption and an increase in the overall political stability of a regime are expected to improve revenue performance of low-income and middle-income countries. Developing countries must actively strive to reduce the opportunities for corruption in tax administration and change the incentive structure for tax officials.

⁹ In reality, the actual flow of aid has been much less than promised. In 2003, total aid from the 22 richest countries to the world's developing countries was just US\$69 billion—a shortfall of US\$130 billion from the 0.7 percent promise. On average, the world's richest countries provided just 0.25 percent of their GNP in official development assistance.

The low-income countries would also benefit from a stable political regime. In countries characterized by political instability, the governments face a credibility problem and the government is unable to define and arbitrate property rights. Such a situation prevents investors from undertaking long-term investments, which in turn lowers economic growth and overall tax revenue.

Given the positive relation between taxes and revenue performance along with the negative relation between indirect taxes and revenue performance, one would be tempted to conclude that a greater reliance on the former would improve tax performance. However, the ground realities in many developing countries may not make such a move possible. In most developing countries there are severe problems in raising tax revenue through direct taxes. It is difficult to develop a mass system of personal income taxes as a significant proportion of the population is extremely poor. Although in some of the middle- and the high-income developing countries there is often scope for rationalizing the rate structure and limiting exemptions to improve revenue from personal income tax, which at times amount to several times the country's per capita GDP and therefore benefit those with high incomes.

The traditional argument against most indirect taxes has been its regressivity, which exacerbates inequality and reduces the tax base, which may lead to a reduction in the share of revenue in GDP. However, in recent years, with the adoption of VAT in many developing countries, the revenue performance response of these have been mixed. VAT has a greater potential in improving the revenue performance in developing countries, compared to traditional commodity taxes, for a number of reasons. The self enforcing mechanism of VAT can induce greater compliance. By including services in its fold, VAT broadens the tax base and it eliminates the cascading effects involved in turnover taxes and some sales tax systems.

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APPENDICES

Appendix A. List of Countries

Albania	Georgia	Panama
Algeria	Ghana	Papua New Guinea
Angola	Grenada	Paraguay
Argentina	Guatemala	Peru
Bahamas, The	Guinea	Philippines
Bahrain	Guinea-Bissau	Poland
Bangladesh	Haiti	Russian Federation
Belarus	Honduras	Rwanda
Belize	Hungary	Samoa
Benin	Indonesia	Sao Tome and Principe
Bolivia	Iran, Islamic Rep.	Senegal
Botswana	Israel	Seychelles
Brazil	Jamaica	Sierra Leone
Bulgaria	Jordan	Singapore
Burkina Faso	Kazakhstan	Slovak Republic
Burundi	Kenya	Slovenia
Cameroon	Korea, Rep.	Solomon Islands
Cape Verde	Kuwait	Somalia
Central African Republic	Kyrgyz Republic	South Africa
Chad	Latvia	Sri Lanka
China	Lesotho	St. Kitts and Nevis
Colombia	Liberia	St. Lucia
Comoros	Lithuania	St. Vincent and the Grenadines
Congo, Dem. Rep.	Macao, China	Sudan
Congo, Rep.	Madagascar	Swaziland
Costa Rica	Malawi	Tajikistan
Cote d'Ivoire	Mali	Tanzania
Croatia	Malta	Togo
Cyprus	Mauritania	Trinidad and Tobago
Czech Republic	Mauritius	Tunisia
Dominica	Mexico	Turkey
Dominican Republic	Moldova	Uganda
Ecuador	Mongolia	Ukraine
Egypt, Arab Rep.	Morocco	United Arab Emirates
El Salvador	Mozambique	Uruguay
Equatorial Guinea	Namibia	Vanuatu
Ethiopia	Nicaragua	Venezuela, RB
Fiji	Niger	Vietnam
Gabon	Nigeria	Zambia
Gambia, The	Oman	Zimbabwe

Appendix B. Classification of Countries According to Income

Low Income Countries	Middle Income Countries	High Income Countries
Angola	Albania	Argentina
Bahrain	Algeria	Bahamas, The
Bangladesh	Belarus	Belize
Benin	Bolivia	Botswana
Burkina Faso	Brazil	Costa Rica
Burundi	Bulgaria	Croatia
Cameroon	Cape Verde	Cyprus
Central African Republic	China	Czech Republic
Chad	Colombia	Dominica
Comoros	Dominican Republic	Gabon
Congo, Dem. Rep.	Ecuador	Grenada
Congo, Rep.	Egypt, Arab Rep.	Hungary
Cote d'Ivoire	El Salvador	Israel
Equatorial Guinea	Fiji	Korea, Rep.
Ethiopia	Georgia	Kuwait
Gambia, The	Guatemala	Latvia
Ghana	Honduras	Lithuania
Guinea	Indonesia	Macao, China
Guinea-Bissau	Iran, Islamic Rep.	Mauritius
Haiti	Jamaica	Mexico
Kenya	Jordan	Oman
Kyrgyz Republic	Kazakhstan	Panama
Lesotho	Morocco	Poland
Liberia	Namibia	Seychelles
Madagascar	Paraguay	Singapore
Malawi	Peru	Slovak Republic
Mali	Philippines	Slovenia
Malta	Russian Federation	St. Kitts and Nevis
Mauritania	Samoa	St. Lucia
Moldova	South Africa	St. Vincent and the Grenadines
Mongolia	Sri Lanka	Trinidad and Tobago
Mozambique	Swaziland	United Arab Emirates
Nicaragua	Tunisia	Uruguay
Niger	Turkey	Venezuela, RB
Nigeria	Ukraine	
Papua New Guinea	Vanuatu	
Rwanda		
Sao Tome and Principe		
Senegal		
Sierra Leone		
Solomon Islands		
Somalia		
Sudan		
Tajikistan		
Tanzania		
Togo		
Uganda		
Vietnam		
Zambia		
Zimbabwe		

Appendix C. Illustrative List of Countries Used in the Regressions

The estimation specifications use a widely different set of countries depending on the set of explanatory variables as well as missing observations. As an illustration we provide below a list of countries included in equations represented in Column (1) to (VI) of Table 5. It can be clearly seen that the observations in each equations are randomly distributed among countries, i.e. all the equations have a mix of high-, middle- and low-income countries.

Column I (105 countries)	Albania, Algeria, Angola, Argentina, Bahrain, Bangladesh, Belarus, Belize, Benin, Bolivia, Botswana, Brazil, Bulgaria, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, China, Colombia, Comoros, Congo, Dem. Rep., Congo, Rep., Costa Rica, Cote d'Ivoire, Croatia, Cyprus, Czech Republic, Dominican Republic, Egypt, Arab Rep., El Salvador, Equatorial Guinea, Ethiopia, Fiji, Gabon, Gambia, The, Georgia, Ghana, Grenada, Guatemala, Guinea, Guinea-Bissau, Haiti, Honduras, Hungary, Indonesia, Iran, Islamic Rep., Israel, Jamaica, Jordan, Kazakhstan, Kenya, Korea, Rep., Kuwait, Kyrgyz Republic, Latvia, Lesotho, Lithuania, Macao, China, Madagascar, Malawi, Mali, Malta, Mauritius, Moldova, Mongolia, Morocco, Mozambique, Namibia, Nicaragua, Niger, Nigeria, Oman, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Rwanda, Senegal, Sierra Leone, Singapore, Slovak Republic, Slovenia, Solomon Islands, South Africa, Sri Lanka, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Swaziland, Tanzania, Togo, Trinidad and Tobago, Tunisia, Uganda, Ukraine, United Arab Emirates, Uruguay, Venezuela, RB, Vietnam, Zambia, Zimbabwe
Column II (104 countries)	Albania, Algeria, Angola, Argentina, Bahrain, Bangladesh, Belarus, Belize, Benin, Bolivia, Botswana, Brazil, Bulgaria, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, China, Colombia, Comoros, Congo, Dem. Rep., Congo, Rep., Costa Rica, Cote d'Ivoire, Croatia, Cyprus, Czech Republic, Dominican Republic, Egypt, Arab Rep., El Salvador, Equatorial Guinea, Ethiopia, Fiji, Gabon, Gambia, The, Georgia, Ghana, Grenada, Guatemala, Guinea, Guinea-Bissau, Haiti, Honduras, Hungary, Indonesia, Iran, Islamic Rep., Israel, Jamaica, Jordan, Kazakhstan, Kenya, Korea, Rep., Kuwait, Kyrgyz Republic, Latvia, Lesotho, Lithuania, Macao, China, Madagascar, Malawi, Mali, Malta, Mauritius, Moldova, Mongolia, Morocco, Mozambique, Namibia, Nicaragua, Niger, Nigeria, Oman, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Rwanda, Senegal, Sierra Leone, Slovak Republic, Slovenia, Solomon Islands, South Africa, Sri Lanka, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Swaziland, Tanzania, Togo, Trinidad and Tobago, Tunisia, Uganda, Ukraine, United Arab Emirates, Uruguay, Venezuela, RB, Vietnam, Zambia, Zimbabwe
Column III (94 countries)	Albania, Algeria, Angola, Argentina, Bangladesh, Belarus, Belize, Benin, Bolivia, Botswana, Brazil, Bulgaria, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, China, Colombia, Comoros, Congo, Dem. Rep., Congo, Rep., Costa Rica, Cote d'Ivoire, Croatia, Czech Republic, Dominican Republic, Egypt, Arab Rep., El Salvador, Equatorial Guinea, Ethiopia, Fiji, Gabon, Gambia, The, Georgia, Ghana, Grenada, Guatemala, Guinea, Guinea-Bissau, Haiti, Honduras, Hungary, Indonesia, Iran, Islamic Rep., Jamaica, Jordan, Kazakhstan, Kenya, Kyrgyz Republic, Latvia, Lesotho, Lithuania, Madagascar, Malawi, Mali, Mauritius, Moldova, Mongolia, Morocco, Mozambique, Nicaragua, Niger, Nigeria, Oman, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Rwanda, Senegal, Sierra Leone, Slovak Republic, Solomon Islands, South Africa, Sri Lanka, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Swaziland, Tanzania, Togo, Trinidad and Tobago, Tunisia, Uganda, Ukraine, Uruguay, Venezuela, RB, Vietnam, Zambia, Zimbabwe

Column IV (51 countries)	Albania, Algeria, Belarus, Botswana, Brazil, Bulgaria, Cameroon, China, Congo, Dem. Rep., Congo, Rep., Costa Rica, Cote d'Ivoire, Croatia, Czech Republic, Dominican Republic, Egypt, Arab Rep., Ethiopia, Gambia, The, Ghana, Guatemala, Guinea, Hungary, Indonesia, Jamaica, Jordan, Kazakhstan, Kenya, Latvia, Lithuania, Madagascar, Moldova, Morocco, Nicaragua, Oman, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Senegal, Sierra Leone, South Africa, Sri Lanka, Trinidad and Tobago, Tunisia, Uruguay, Venezuela, RB, Vietnam, Zambia, Zimbabwe
Column V (72 countries)	Albania, Algeria, Angola, Argentina, Bangladesh, Belarus, Bolivia, Botswana, Brazil, Bulgaria, Burkina Faso, Cameroon, China, Colombia, Congo, Dem. Rep., Congo, Rep., Costa Rica, Cote d'Ivoire, Croatia, Czech Republic, Dominican Republic, Egypt, Arab Rep., El Salvador, Ethiopia, Gabon, Gambia, The, Ghana, Guatemala, Guinea, Guinea-Bissau, Haiti, Hungary, Indonesia, Jamaica, Jordan, Kazakhstan, Kenya, Latvia, Lithuania, Madagascar, Malawi, Mali, Moldova, Mongolia, Morocco, Mozambique, Nicaragua, Niger, Nigeria, Oman, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Senegal, Sierra Leone, Slovak Republic, South Africa, Sri Lanka, Tanzania, Togo, Trinidad and Tobago, Tunisia, Uganda, Ukraine, Uruguay, Venezuela, RB,, Vietnam, Zambia, Zimbabwe
Column VI (53 countries)	Albania, Algeria, Belarus, Botswana, Brazil, Bulgaria, Cameroon, China, Congo, Dem. Rep., Congo, Rep., Costa Rica, Cote d'Ivoire, Croatia, Czech Republic, Dominican Republic, Egypt, Arab Rep., Ethiopia, Gambia, The, Ghana, Guatemala, Guinea, Hungary, Indonesia, Jamaica, Jordan, Kazakhstan, Kenya, Latvia, Lithuania, Mexico, Moldova, Mongolia, Morocco, Nicaragua, Oman, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Senegal, Sierra Leone, South Africa, Sri Lanka, Trinidad and Tobago, Tunisia, Uganda, Uruguay, Venezuela, RB, Vietnam, Zambia, Zimbabwe

Appendix D. Summary of Findings of Empirical Studies

Author	Significant Variables (Sign)	Explanatory	Other Variables Included in the Regressions	Goodness of Fit	Countries Covered	Time Period
Lotz and Morss (1967) ^a	Per capita GNP (+), trade share (+)			10 to 60%	72 developing countries	1962-66
Chelliah (1971) ^b	Mining share (+), non mineral export share (+), agriculture share (-)		Per capita non export income, export ratio	25 to 50%	50 developing countries	1953-55 and 1966-68
Chelliah, Baas and Kelly (1975) ^b	Mining share (+), agriculture share (-)		Trade share, non mineral exports, per capita non export income	11 to 45%	47 developing countries	1969-71
Tait, Grätz and Eichengreen (1979) ^b	Mining share (+), non mineral export share (+), export share (+)		Per capita income, per capita non export income, agriculture share	26 to 54%	47 developing countries	1972-76
	Mining share (+), non mineral export share (+), export share (+)		Per capita income, per capita non export income, agriculture share	34 to 59%	63 developing countries	
Tanzi (1981) ^c	Mining share (+), non mineral export share (+)		Per capita non export income	15 to 52%	34 Sub Saharan African countries	1977
Tanzi (1992) ^c	Agriculture share (-), import share(+), foreign debt share (+)		Per capita income,	54%	88 developing countries	1978 -88
Leuthold (1991)	Trade share (+), agriculture share (-)		Foreign grants, mining share	38%	8 African countries	1973-81
Stotsky and WoldeMariam (1997) ^c	Agriculture share (-), mining share (-), export share (+), per capita GDP (+), IMF dummy (+)		Manufacturing share, import share	57 to 94%	46 Sub Saharan African countries	1990-95
Ghura (1998) ^c	Per capita income (+), agriculture share (-), trade openness (+), existence of oil and non oil mining sector (+), structural reforms (+), human capital development (+), inflation (-), corruption (-)		Percentage change in terms of trade, percentage change in real exchange rate, change in external debt to GDP ratio	Not Reported	39 Sub Saharan African countries	1985-96
Piancastelli (2001) ^c	Trade share (+), agriculture share (-), manufacturing share (+), services share (+)		Per capita GDP	38 to 84%	75 countries	1985-95
Eltony (2002) ^c	Per capita GDP (+), mining share (-)		Import share, export share, manufacturing share, agriculture share, outstanding foreign debt	50%	6 oil producing Arab countries	1994-2000
	Per capita GDP (+), import (+), export (+), mining share (+), agriculture share (-), outstanding foreign debt (+)		Export share, manufacturing share,	78%	10 non oil producing Arab countries	
Bird, Martinez-Vasquez & Torgler (2004) ^d	Population growth (-), agriculture share (-), inequality (-), shadow economy (-), institutions (+), entry regulations (-)		Per capita GDP,	48 to 85%	110 developing and transitional countries	1990-99

a. Dependent variable is ratio of tax revenue to GNP.

b. Dependent variable is ratio of tax revenue (excluding social security payments) to GNP.

c. Dependent variable is ratio of tax revenue to GDP.

d. Dependent variable is ratio of tax revenue to GDP and ratio of current revenue (minus grants) to GDP.