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The determinants of tax revenue and tax effort in developed and developing countries: Theory and new evidence 1995-2015

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The Determinants of Tax Revenue and Tax Effort in Developed and Developing Countries: Theory and New Evidence 1995-2015

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The Determinants of Tax Revenue and Tax Effort in Developed and Developing Countries: Theory and New Evidence 1995-2015

Marcelo Piancastelli and A.P. Thirlwall¹

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Abstract

This paper measures the tax effort of a sample of fifty-nine developed and developing countries over the period 1995-2015 by comparing a country's actual tax/GDP ratio with the ratio predicted derived from an international tax function which relates tax revenue to various measures of a country's taxable capacity such as the level of per capita income; the share of trade in GDP; the productive structure, and the level of financial deepening. The tax function is estimated using cross section data; pooled time series/cross section data, and panel data using a fixed effects estimator. The results are compared and show a range of tax effort from South Africa with the highest effort and Switzerland with the lowest effort. Implications for policy are drawn.

Keywords: Tax ratios; tax effort

JEL Classification: H2

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Non-technical Summary

Tax Revenue is necessary for the provision of public goods and to pay for social expenditures. Developing countries are in particular need of both, where tax revenue is often less than 20 percent of GDP. This paper attempts to assess the tax effort of a selection of both developing and developed countries over the period 1995 to 2015 by estimating an international tax function, which makes the tax revenue of countries a function of the level of per capita income; the share of trade in GDP; the monetisation of an economy, and the productive structure of countries, and then comparing actual tax revenue with that predicted from the estimated model. Tax effort is measured by the ratio of the actual tax/GDP ratio to the predicted ratio. Seventeen of the thirty-four developing countries taken are estimated to have a weak tax effort with a ratio less than unity. Policy recommendations include widening the tax base; tackling avoidance and evasion, and linking international aid to tax effort.

Introduction

Almost all countries – both developed and developing – require more tax revenue for the provision of public goods and for tackling poverty. Spending on infrastructure, public utilities, health and education all depend on raising tax revenue in sufficient quantities (Kaldor, 1963; IMF, 2011). Without it, governments must borrow which increases public debt, and may cause fiscal crisis in the future if debt becomes too high as a proportion of gross domestic product (GDP), and countries find difficulty in repaying. As Bird (1975) says ‘even if one does not accept the simple capital formation model of development - - - it seems clear that no poor country can get very far without in some sense “mobilising” more resources, at least to some degree through taxation’. Cody (2018) has recently reiterated the point more explicitly: ‘a key challenge for developing economies wishing to strengthen their social protection systems and expand access to education and health is how to raise the necessary revenue in the context of a large informal sector’. Lewis (1966) in his book *Development Planning* was far too cautious when he said ‘most underdeveloped countries need to raise at least 17 percent of gross domestic product in taxes and other government revenue, taking central and local authorities together’. Tax revenue in most developing countries is now higher than that and there are now still considerable unmet expenditure needs. Moore, Prichard and Fjeldstad (2018) highlight the situation in Africa where the ratio of tax to GDP has increased in recent years to an average of 18 percent. Yet the revenues fall far short of spending needs. As the authors say ‘so much more needs to be done’. Unfortunately in Africa, and elsewhere, tax authorities are up against powerful vested interests that obstruct reform.

Table 1 below gives the tax ratio and the total government debt to GDP ratio for a selection of forty-two developing countries in 2010 and 2016, compared to a sample of twenty-six developed countries for the same years. It can be seen that the tax ratio for developing countries is much lower than for developed countries. The average ‘tax take’ of developing countries in 2016 was 20.4 percent compared with 33.4 percent in developed countries. It can also be seen that the debt ratio is lower, reflecting the difficulty that poor countries have to access capital markets and borrow to finance government expenditure. Countries in real difficulty would be countries with a relatively low tax ratio and a relatively high debt ratio. From our sample of countries here, countries such as Ghana, India, Malaysia, Mexico, Pakistan, Sierra Leone and Sudan would appear to be in particular trouble. One of the things we shall explore later is whether the tax effort of some of these countries is ‘good’ or ‘bad’, and if the latter, how the tax ratio might be raised.

Table 1: Tax and Debt Ratios of Developing and Developed Countries

Developing Countries					Developed Countries				
	Total Tax Revenue		Total Gov. Debt			Total Tax Revenue		Total Gov. Debt	
	2010	2016	2010	2016		2010	2016	2010	2016
Argentina	21.1	21.4	42.0	53.3	Australia	23.3	24.8	29.3	40.7
Belize	27.3	26.6	80.2	76.6	Austria	43.5	44.1	82.4	83.7
Bolivia	23.3	34.7	37.6	46.2	Belgium	40.1	38.6	99.7	105.7
Botswana	36.3	33.5	21.6	15.2	Canada	16.9	17.4	81.1	91.1
Brazil	28.8	29.5	61.3	73.5	Denmark	39.9	39.2	42.6	37.7
Cameroon	16.5	18.2	14.7	31.5	Finland	35.4	37.7	47.1	63.0
Chile	21.4	20.8	8.6	21.0	France	43.3	44.7	85.1	96.6
Colombia	21.5	24.2	72.3	58.0	Germany	27.7	28.1	80.9	68.2
Congo, D R	14.3	13.5	30.9	16.8	Greece	40.1	48.7	146.2	183.5
Costa Rica	23.1	24.8	28.3	44.9	Iceland	28.5	46.5	105.3	52.7
Dominican R	13.8	15.6	23.7	35.0	Ireland	22.0	57.1	72.8	86.1
Egypt	24.8	21.0	85.8	96.8	Italy	37.2	38.6	115.4	132.0
El Salvador	22.0	24.0	57.5	52.7	Japan	9.9	12.2	162.3	235.6
Fiji	24.0	27.6	56.2	46.5	Korean, Rep.	21.0	27.3	33.9	40.4
Ghana	17.5	19.4	-	73.4	Luxembourg	41.0	41.5	19.8	20.8
Guatemala	11.1	11.0	24.4	22.1	Malta	25.0	28.0	67.6	57.6
India	13.3	12.6	52.2	50.3	Netherlands	38.1	39.2	59.3	61.8
Indonesia	14.5	12.5	26.2	31.4	New Zealand	32.3	32.4	34.9	28.3
Iran	25.4	16.0	11.7	48.9	Norway	47.0	44.9	42.3	36.7
Jordan	31.0	23.8	67.1	95.1	Portugal	34.3	38.0	96.2	129.9
Kenya	19.8	20.1	44.4	53.5	Singapore	17.0	19.0	102.9	106.8
Madagascar	11.9	13.6	31.7	38.4	Spain	14.7	15.8	53.6	99.0
Malaysia	19.4	17.3	49.6	52.7	Sweden	33.0	33.0	38.6	42.2
Mauritius	22.1	22.8	36.8	60.1	Switzerland	17.3	17.7	21.6	19.8
Mexico	18.0	19.8	42.3	56.8	United Kingdom	34.8	35.4	82.8	88.2
Morocco	31.0	26.8	50.9	64.7	United States	16.5	18.7	85.6	107.2
Namibia	28.3	30.6	16.9	23.1	N.B All figures as a percentage of GDP. Source: International Monetary Fund; GFS Yearbook and data files; World Bank and OECD GDP estimates. Updated 08.28.2018.				
Nepal	14.9	21.6	33.9	27.3					
Pakistan	13.8	11.0	60.6	67.6					
Panama	23.5	20.1	38.6	37.1					
Paraguay	19.9	22.2	15.6	24.9					
Peru	20.3	18.1	23.7	23.2					
Philippines	13.4	15.2	52.4	45.4					
Sierra Leone	9.8	9.8	46.8	54.9					
South Africa	28.1	30.9	26.0	51.6					
Sudan	19.3	9.8	64.4	91.4					
Thailand	19.0	20.0	26.9	35.3					
Tunisia	29.0	14.9	40.7	61.2					
Turkey	31.7	33.1	47.4	31.9					
Uruguay	29.9	36.1	44.2	50.7					
Venezuela	21.2	15.7	36.5	31.3					
Zambia	13.9	18.1	18.0	49.4					

The basic question we shall be trying to answer is whether the tax ratio is lower in developing countries because the tax base is lower, or whether the developing countries are not making as much tax effort as they could, either because they apply low tax rates or allow far too much tax evasion and tax avoidance. One of the ways of addressing this issue, first developed by Lotz and Morss (1967)² at the IMF, is to estimate a tax revenue equation across countries, in which tax revenue as a percent of GDP (or tax ratio) is made a function of various tax bases and the structural characteristics of countries, such as per capita income and the share of trade, agriculture, industry and services in GDP, and then to compare the actual tax ratio of each country to the tax ratio predicted by the equation, taking values of the various independent variables for each individual country. The difference between the actual tax ratio and that predicted gives a measure of tax effort. Pooled time series/cross section data, panel data, or cross section data can be used for estimation of tax revenue.

Work of this type is not without its critics, but in our view many of the criticisms are not justified. Bird (1975), for example, makes two major objections (apart from the fact that the data used for estimation may be unreliable). First, he argues that there is no *a priori* justification for the use of the selected variables as a measure of taxable capacity. In the case of per capita income, for example, as a determinant of tax revenue, he says ‘presumably it is included because it is a proxy for a potentially higher tax base, or a larger “taxable surplus”, [but] income is surely as much a “demand” as it is a “supply” factor: the identification problem seems insuperable in this respect’. By “demand” Bird means the willingness to tax, and he makes the same argument with respect to other variables (as well as per capita income) such as the share of trade, agriculture and mining in GDP. He goes on ‘the distinction between capacity and willingness is a terribly fuzzy one: indeed, one might say that ‘capacity’ without ‘willingness’ is not really ‘capacity’ - or ‘effective capacity’, if I may coin a term – at all’. This is far too iconoclastic. If the capacity is there, measured by variables such as per capita income and the structural characteristics of countries, but the willingness to tax is low, this is exactly what leads to a low tax effort. A lack of willingness is a lack of effort.

² And others subsequently by Shin (1969); Bahl (1971); Chelliah et al. (1975); Tait et al. (1979); Piancastelli (2001).

A second objection of Bird (1975) is that since the estimation of tax revenue comes from cross section or panel data, inferences cannot be drawn for individual countries. He states that ‘there is no meaningful sense in which the average experience measured by cross section analysis can be considered as a standard of comparison’ - - - ‘undue attention to such international comparisons is more likely to detract from, than illuminate, the needed analysis of problems and policies in individual developing countries’. Again, we believe this is far too iconoclastic. While it may be true that a country with an actual tax ratio above that predicted from the cross section equation is because a variable has been missed from the equation determining the actual tax ratio (which may be important for an individual country), the *opposite* is extremely unlikely that a country with an actual tax ratio below predicted is making a good tax effort, and that there is not scope for improvement based on taxing individuals, trade or sectors of the economy, more heavily. Thus, it is hard to agree with Bird’s central conclusion that ‘there is no merit at all in the contention that differences between predicted and actual values - - - measure in any meaningful way the scope for change in a particular country, or the gap that can (or should) be closed through additional “effort”’.

The purpose of this paper is to re-examine this issue for more recent years taking a sample of 59 developing and developed countries over the period 1996-2015. We will employ various econometric techniques including pooled time series/cross section estimation, OLS cross section, and panel data analysis to compare results and to check for robustness. We will choose the most satisfactory results to give a ranking of the tax effort of our sample of countries, and end with some policy conclusions.

There are five major differences between the present study and most previous studies (which we will briefly survey below). First we use pooled and panel data which gives us many more observations. Most previous studies use cross section data. Secondly, we take logarithms of the variables to narrow the variance of the data, giving a better goodness of fit of the equations estimated. Thirdly, we include in the equations a measure of the monetisation of an economy, which turns out to make a significant difference to the explanatory power of the model used to measure the determinants of differences in the tax ratio of countries. Fourthly, given the higher variance in tax ratios explained by the model, we can have more confidence in the estimated tax effort ratios. Where the predicted countries’ tax ratios come from equations where the correlation coefficient is low, a high estimated tax effort may be the

result of a highly significant variable missing from the equation, which is important for an individual country. The country may seem to have a high tax effort, but an important variable has been missed out from the estimating equation. An example would be the monetisation of an economy (which we include), or the importance of minerals unless they are accounted for in the trade ratio³. Lastly, the study uses more recent data from 1996-2015.

Survey of Previous Studies

To estimate the determinants of tax revenue as a proportion of GDP, and tax effort, several different independent explanatory variables have been used in the past. Lotz and Morris (1967) were the first to measure the tax effort of countries taking a sample of 72 developed and developing countries for an average of years in the early 1960s⁴. They compare the *actual* tax ratio of countries with the ratios predicted from cross-section regressions relating the tax ratio to the level of per capita gross national product (GNP) and the share of exports and imports in GNP. Tax effort is measured as the percentage *difference* in the actual tax ratio minus the predicted tax ratio⁵. The influence of per capita GNP is estimated both separately and jointly with the trade share. Both per capita income and the trade share are significant, but the tax effort ranking differs significantly when the trade share is introduced.

Shin (1969) takes a sample of 47 developed and developing countries for the years 1963-65 and adds three other variables to per capita GNP and the share of trade in GNP to explain differences in countries' tax ratio. They are: the 'agricultural income ratio as a measure of industrialisation, commercialisation and urbanisation'; the rate of change of prices, and the growth of population. The size of the agricultural sector is expected to have a negative effect on the tax ratio because of a smaller 'surplus' to tax. Inflation is expected to have a positive effect on the tax ratio if the tax system is progressive and pushes individuals into higher tax brackets, and also increases profits. Population growth is expected to reduce the tax ratio by increasing the population dependency rate leading to more tax exemptions. For the 47 countries as a whole, the statistically significant variables turn out to be per capita GNP; the

³ We do not include mineral production or exports in our own model because they are part of the trade ratio (see later).

⁴ Studies prior to this focussed on explaining tax revenue *shares* across countries, rather than tax effort itself. See Bahl (1971) for a survey.

⁵ In many later studies, tax effort is measured by the *ratio* of the actual tax ratio to the predicted ratio.

agricultural income ratio and population increase⁶. Tax effort, as in Lotz and Morris, is measured by the *percentage* deviation of the actual from the predicted tax ratio.

Bahl (1971) takes 49 countries over the period 1966-1968 and uses three main variables to explain tax ratio differences, namely the size of the foreign trade sector measured by the export ratio, the import ratio, and the export plus import ratio; the stage of development as measured both by per capita income and the share of agriculture in GNP, and the sectoral composition of value-added measured by the share of the mining sector in GNP. The export share and the mining share in GNP are highly correlated. Tax effort in this paper is measured as the *ratio* of the actual tax ratio to the predicted tax ratio⁷. A country with a ratio above unity is considered to be making a 'good effort'.

Chelliah et. al. (1975) basically use the same equation as Bahl (1971). They take 47 countries over the period 1969-1971 and use as independent variables: per capita non-export income; the percentage contribution of the mining sector to GNP; the contribution of non-mineral exports to GNP, and the share of agriculture in GNP – with the variables used in five different combinations. The best fit with an r^2 of 0.442 comes from relating the tax ratio to the share of mining in GNP (positive) and the share of agriculture in GNP (negative). Twenty three countries have a tax effort greater than unity and twenty four less than unity.

Tait et.al (1979) update the study of Chelliah et.al. (1975) using the same equations and the same 47 countries over the period 1972-1977. The authors also use a new sample of 63 developing countries. The authors dislike the term 'tax effort' and prefer to label their results 'international tax comparison indices'. The rankings using the same five equations of Chelliah et.al. (1975) are all quite stable. The preferred equation for making 'international tax comparison indices' is:

$$T/GNP = 9.99 - 0.0008(Y_p - X_p) + 0.407(N_y) + 0.194(X_y) : r^2 = 0.413$$

(6.15) (0.34) (5.61) (3.52)

⁶ For 16 high income countries, none of the variables are significant. For 31 low income countries, the agricultural income ratio and price inflation are significant at the 95 percent confidence level, and population growth at the 90 percent level.

⁷ In all subsequent papers, tax effort is measured in this way, not by the percentage difference in the actual and predicted tax ratio.

where $(Y_p - X_p)$ is per capita non-export income; N_y is the share of minerals in GNP, and X_y is the share of non-mineral exports in GNP (t-statistics in brackets). Note that still a lot of difference in the tax ratio between countries is left unexplained.

Piancastelli (2001) estimates a panel fixed-effects model for 75 countries over the period 1985 to 1995 giving 825 observations. The tax ratio and tax effort are estimated from an equation with the log of per capita GDP (PCY); the share of trade in GDP $(X-M)/GDP$, and the share of agriculture in GDP (A/GDP) as the independent variables. The estimated equation is:

$$\ln T/Y = 1.742 + 0.102(\ln PCY) + 0.158[\ln(X-M)]/GDP - 0.113[\ln(A/GDP)]$$

(5.43) (3.69) (4.30) (3.84)

with t-statistics in brackets. The correlation coefficient is 0.838 which is much higher than in the studies of Chelliah et.al. (1975) and Tait et.al. (1979). There is also a higher proportion of countries with a good tax effort with 41 countries with a tax effort ratio greater than unity, and 34 less than unity. Latin America does particularly badly with only 4 out of 17 countries with a ratio greater than unity.

Gupta (2007) at the IMF looks at the determinants of tax revenue using a panel of 105 countries over the period 1980 to 2004, and presents results from both random and fixed-effects estimation without using the Hausman test to discriminate between the two. Aid as a percentage of GDP, and an index of corruption, are included as independent variables along with the log of per capita income; agriculture's share of GDP and imports as a share of GDP (the export share is not considered)⁸. Per capita income is the most significant variable, but is more important in high-income countries than in low-income countries. Tax effort indices are constructed, and, as in other studies, tax effort appears weak in Latin America, but stronger in Africa.

The Model

We have chosen to take six main individual independent variables to explain the tax performance of countries over the period 1996-2015, all in logarithms for the reason mentioned earlier. They are: the per capita income of countries

⁸ Per capita income and agriculture's share of GDP are not included in the same regressions because of multi-collinearity.

(PCY) as a measure of the capacity of individuals to pay tax; the share of trade in GDP $(M+X)/Y$ (where M is imports and X is exports) as a measure of the capacity of a country to tax trade; the share of industry (I/GDP) , agriculture (A/GDP) and services (S/GDP) in GDP as a measure of the capacity to tax profits and land, and the degree of monetisation of an economy measured by M2 money as a percentage of GDP (M/GDP) ⁹. This is the first study to our knowledge that includes a monetary variable to measure the degree of sophistication of an economy as an indication of its ability to tax due to higher levels of literacy and administrative capability. The basic equation to be estimated is therefore:

$$\ln(T/GDP) = a + b_1(\ln PCY) + b_2 [\ln(X+M)/GDP] + b_3 [\ln(I/GDP)] + b_4[\ln(S/GDP)] + b_5[\ln(A/GDP)] + b_6[\ln(M/GDP)] + e$$

where e is a stochastic error term. The expected signs of the per capita income variable, the trade variable and the broad money variable are positive, but the signs on the variables reflecting the structure of economies are ambiguous depending on the difficulty or otherwise of taxing the different sectors. Agriculture and a large petty service sector in an economy may be difficult to tax, in which case the coefficients would be negative.

Three estimation techniques are used for comparison. First, we use a pooled time series/cross section estimator giving 1,121 observations for 59 countries over the period 1996 to 2015. Secondly, we apply panel estimation to the data, and test for random versus fixed effects. Thirdly, a cross section estimator is used to even out cyclical fluctuations in the data. In all cases, we first test individually the significance of per capita income, the trade ratio and the broad money ratio, because these are potentially the most likely variables to determine tax revenue. To these variables, we then add individually the variables reflecting the structure of production, namely, the share of agriculture, industry, and services in GDP, giving six equations in all. All the equations are estimated using robust standard errors to allow for heteroscedasticity. The results are shown in Tables 2, 3 and 4, respectively.

In Table 2, using pooled data, per capita income is significant on its own, and doesn't lose its significance when combined with other variables. It is a robust

⁹ M2 money consists of central government national currency holdings, other financial corporations, State and local governments, Public non-financial corporations, other resident sector, non-residents national currency holdings.

variable with an elasticity of just over 0.1. The trade ratio is also significant by itself and when other variables are added. Its elasticity is just over 0.2. Likewise, broad money is statistically significant and robust to the addition of other variables, with an elasticity of just over 0.1 in the full equation. The share of agriculture and services in GDP are both significantly positive, but the share of industry, surprisingly, is not. The service sector has by far the highest elasticity. The test statistics for functional form and the distribution of the error term are both passed, so we can have some confidence in the results.

Table 2: Tax Effort Using Pooled Data (1996-2015)

Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)
Ln(GDP per capita)	0.11*** (0.01)			0.14*** (0.01)	0.14*** (0.01)	0.11*** (0.01)
Ln(Trade/GDP)		0.25*** (0.02)		0.22*** (0.02)	0.22*** (0.01)	0.22*** (0.01)
Ln(Broad Money/GDP)			0.18*** (0.03)	0.12*** (0.02)	0.11*** (0.02)	0.11*** (0.02)
Ln(Agriculture/GDP)				0.07*** (0.02)	0.07*** (0.02)	0.12*** (0.02)
Ln(Industry/GDP)					-0.05* (0.03)	0.06** (0.02)
Ln(Services/GDP)						0.57*** (0.05)
Constant	- 2.78*** (0.05)	- 1.72*** (0.01)	- 1.48*** (0.05)	- 2.51*** (0.07)	- 2.59*** (0.09)	- 1.79*** (0.11)
Diagnostics						
No. of observations	1121	1121	1121	1121	1121	1121
r^2	0.23	0.13	0.04	0.35	0.35	0.40
Functional form	F=6.36 P=0.00	F=5.42 P=0.00	F=12.41 P=0.00	F=3.79 P=0.00	F=3.41 P=0.02	F=1.78 P=0.15
Normality	W=0.95 P=0.00	W=0.99 P=0.00	W=0.99 P=0.00	W=0.98 P=0.00	W=0.98 P=0.00	W=0.98 P=0.00

Notes: The numbers in parentheses are robust standard errors. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Functional Form is measured by the Ramsey RESET test. Normality is measured by the Shapiro-Wilk W test. All regressions include 59 country observations

In Table 3, the use of panel data show similar results. Applying the Hausman test, the fixed effects estimator is supported for all equations. Per capita income is always statistically significant, but with a much lower elasticity than with pooled data – between 0.03 and 0.06. The trade ratio is always statistically significant but with a slightly lower elasticity than with the pooled data. Broad money is also significant but with a much lower elasticity than with the pooled data. The shares of agriculture and services in GDP are significantly positive, but again the share of industry is not. The test statistics reject the null of omitted variable bias and a non-normal distribution of the error term.

Table 3: Tax Effort Using Panel Data with Fixed Effects (1996-2015)

Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)
Ln(GDP per capita)	0.03 (0.03)			0.06 (0.03)	0.06 (0.04)	0.05 (0.04)
Ln(Trade/GDP)		0.13 (0.08)		0.15** (0.8)	0.16** (0.08)	0.17** (0.07)
Ln(Broad Money/GDP)			0.06 (0.05)	0.06 (3.8)	0.05 (0.05)	0.05 (0.05)
Ln(Agriculture/GDP)				0.11** (0.05)	0.11** (0.04)	0.13*** (0.05)
Ln(Industry/GDP)					-0.05 (0.09)	-0.01 (0.06)
Ln(Services/GDP)						0.22 (0.16)
Constant	-2.10*** (0.26)	-1.77*** (0.03)	-1.71*** (0.10)	-1.90*** (0.31)	-1.94*** (0.34)	- 1.65*** (0.31)
Diagnostics						
No. of observations	1121	1121	1121	1121	1121	1121
r^2	0.01	0.02	0.01	0.06	0.07	0.07
Functional form	F=5.10 P=0.02	F=3.34 P=0.07	F=5.11 P=0.02	F=7.10 P=0.00	F=5.94 P=0.02	F=13.2 P=0.9
Normality	W=0.98 P=0.00	W=0.99 P=0.00	W=0.99 P=0.00	W=0.97 P=0.00	W=0.99 P=0.00	W=0.99 P=0.00
Hausman	$\chi^2(1)=8.55$ P=0.00	$\chi^2(1)=2.3$ P=0.13	$\chi^2(1)=1.6$ P=0.21	$\chi^2(1)=17.27$ P=0.00	$\chi^2(1)=17.98$ p=0.00	$\chi^2(1)=19.56$ p=0.00

Notes: The numbers in parentheses are robust standard errors. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Functional Form is measured by the Ramsey RESET test. Normality is measured by the Shapiro-Wilk W test. All regressions include 59 country observations.

In Table 4, the cross section results tell a rather different story. Per capita income and the trade ratio are statistically significant and show very similar elasticities to the pooled data, but broad money is not significant, and nor is the share of agriculture and industry in GDP. But the share of services is highly significant. Equation (6), which we use for estimating tax effort, passes the Ramsey Reset test for functional form, and the Shapiro-Wilk test for the normal distribution of the error term.

Table 4: Tax Effort Using Cross Sectional Data (1996-2015)

Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)
Ln(GDP per capita)	0.11*** (0.03)			0.13*** (0.05)	0.14*** (0.05)	0.11*** (0.04)
Ln(Trade/GDP)		0.25*** (0.06)		0.22*** (0.06)	0.22*** (0.06)	0.22 (0.14)
Ln(Broad Money/GDP)			0.25* (0.13)	0.15 (0.13)	0.14 (0.13)	0.14 (0.12)
Ln(Agriculture/GDP)				0.07 (0.09)	0.06 (0.09)	0.12 (0.09)
Ln(Industry/GDP)					-0.07 (0.134)	0.07 (0.13)
Ln(Services/GDP)						0.62*** (0.19)
Constant	-2.80*** (0.27)	-1.71*** (0.05)	-1.37*** (0.23)	-2.47*** (0.36)	- 2.58*** (0.43)	-1.70*** (0.57)
Diagnostics						
No. of observations	59	59	59	59	59	59
r^2	0.27	0.14	0.05	0.39	0.39	0.45
Functional form	F=0.34 P=0.79	F=0.20 P=0.89	F=0.28 P=0.89	F=0.45 P=0.70	F=0.44 P=0.72	F=0.13 P=0.9
Normality	W=0.95 P=0.01	W=0.98 P=0.52	W=0.98 P=0.61	W=0.98 P=0.54	W=0.98 P=0.50	W=0.98 P=0.71

Notes: The numbers in parentheses are robust standard errors. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. All Variables are an average over the period. All regressions include 59 country observations. Functional Form is measured by the Ramsey RESET test. Normality is measured by the Shapiro-Wilk W test.

Tax Effort

To estimate the tax effort of countries, we ignore the panel data estimating equations because of their low explanatory power, and use equation (6) from the pooled and cross section estimates in Tables 2 and 4, respectively. The results are shown in Tables 5 and 6. The fitted values from the estimation equations show a close fit with the actual tax ratios of countries. From the pooled data, and cross section, estimates, the average fitted value is 16.59 percent compared with the actual tax ratio average of 17.09 percent. The rank correlation of tax effort measured from the pooled and cross section estimation equations is 0.97.

The tax effort of countries is measured by the ratio of the actual tax ratio to the fitted value from the regressions. A ratio in excess of unity suggests a 'good' tax effort, and a ratio below one suggests a country is not using to the full its taxable capacity compared with comparator countries. From Table 5, which uses the pooled regressions, it can be seen that 34 countries have a 'good' tax effort with South Africa heading the list. From Table 6, which uses the cross section estimates, 32 countries have a 'good' tax effort, with South Africa again at the top. Developing countries which show a 'good' tax effort include Botswana, Morocco, Turkey, Jordan, Kenya, Colombia, Indonesia, Uruguay, Tunisia, Chile, Venezuela, Cameroon, Zambia, Sierra Leone, Brazil, Bolivia, Peru, Ghana and Panama.

A tax effort ratio less than unity implies a poor tax effort by international standards of comparison. Switzerland turns out to be the worst performer. It has the potential tax ratio of 19.3 percent of GDP, based on the level of per capita income, trade share, structure of production and monetisation of the economy, but its actual tax/GDP ratio is only 9.43 percent. The worst performers among developing countries are Iran, Guatemala, Costa Rica, Dominican Republic, India, Paraguay, Mauritius, Thailand, Malaysia, Madagascar, Pakistan, Nepal, Philippines, Mexico, Argentina and El Salvador. Panama is on the margin with a tax effort ratio just above unity using estimates from the pooled regression and just below unity using the cross section estimates. Four of these countries – India, Pakistan, Malaysia and Mexico – are among the countries mentioned at the beginning which have both a low tax ratio and a relatively high debt ratio.

Table 5 Tax Effort Indices - Full Sample: Pooled data estimates

Countries	Tax Ratio Actual (a)*	Tax Ratio Fitted (b)**	Tax Effort Index (c =a/b)	Countries	Tax Ratio Actual (a)*	Tax Ratio Fitted (b)**	Tax Effort Index (c = a/b)
South Africa	25.237	14.802	1.705	Ghana	13.667	13.347	1.024
Denmark	32.574	19.912	1.636	Greece	20.211	19.977	1.012
UK	25.516	17.661	1.445	Belize	20.826	20.605	1.011
Norway	26.558	18.671	1.422	Panama	21.537	21.516	1.001
Sweden	27.889	19.706	1.415	El Salvador	12.333	12.522	0.985
Botswana	20.621	14.947	1.380	Argentina	14.458	14.852	0.973
Morocco	20.281	14.954	1.356	Malta	24.984	26.149	0.955
New Zealand	27.142	20.668	1.313	Mexico	14.826	15.683	0.945
Australia	22.979	18.239	1.260	Philippines	13.298	14.336	0.928
Turkey	19.884	15.854	1.254	Nepal	10.597	11.458	0.925
Italy	22.753	18.533	1.228	Pakistan	10.667	11.767	0.906
Jordan	18.753	15.591	1.203	Netherlands	21.232	24.045	0.883
Kenya	16.281	13.587	1.198	Madagascar	11.158	12.649	0.882
Colombia	15.353	13.026	1.179	Mauritius	16.963	19.553	0.868
Ireland	25.137	21.726	1.157	Thailand	14.716	16.979	0.867
Finland	21.705	19.339	1.122	Malaysia	15.547	18.048	0.861
Indonesia	13.649	12.204	1.118	Paraguay	13.386	15.884	0.843
Uruguay	17.979	16.080	1.118	India	9.825	11.906	0.825
Tunisia	19.405	17.362	1.118	Spain	14.679	17.854	0.822
Chile	17.226	15.442	1.116	Japan	12.332	15.211	0.811
Portugal	21.158	19.292	1.097	Dominican Rep.	13.311	16.522	0.806
Venezuela	15.205	13.896	1.094	Korea	14.068	18.144	0.775
Cameroon	13.965	12.778	1.093	Costa Rica	13.789	18.064	0.763
Iceland	24.200	22.226	1.089	Guatemala	11.105	15.067	0.737
Zambia	15.035	13.890	1.082	United States	10.832	15.081	0.718
Romania	17.342	16.236	1.068	Canada	13.242	19.904	0.665
Sierra Leone	8.509	7.994	1.064	Germany	11.242	17.038	0.660
Brazil	14.437	13.609	1.061	Iran	7.553	13.042	0.579
Bolivia	14.930	14.193	1.052	Switzerland	9.432	19.624	0.481
Peru	14.758	14.191	1.040				

Full Sample Average Values: 17.09 (Actual); 16.59(Fitted)

Notes: * Total Tax Revenue / GDP

** Derived from equation 6, Pooled Time Series Cross-Section results in Table 2

Table 6 Tax Effort Indices - Full Sample: Cross Section estimates

Countries	Tax Ratio Actual (a)*	Tax Ratio Fitted (b)**	Tax Effort Index (c=a/b)	Countries	Tax Ratio Actual (a)*	Tax Ratio Fitted (b)**	Tax Effort Index (c = a/b)
South Africa	25.237	14.876	1.696	Peru	14.758	14.568	1.013
Denmark	32.574	19.877	1.639	Belize	20.826	14.305	1.456
UK	25.516	17.743	1.438	Greece	20.211	20.461	0.988
Norway	26.558	18.741	1.417	Panama	21.537	21.914	0.983
Sweden	27.889	19.784	1.410	El Salvador	12.333	12.562	0.982
Botswana	20.621	14.842	1.389	Argentina	14.458	15.128	0.956
Morocco	20.281	14.833	1.367	Malta	24.984	26.572	0.940
New Zealand	27.142	20.952	1.295	Mexico	14.826	15.791	0.939
Turkey	19.884	15.868	1.253	Philippines	13.298	14.251	0.933
Australia	22.979	18.587	1.236	Nepal	10.597	11.409	0.929
Italy	22.753	18.792	1.211	Pakistan	10.667	11.708	0.911
Jordan	18.753	15.521	1.208	Madagascar	11.158	12.471	0.895
Kenya	16.281	13.681	1.190	Malaysia	15.547	17.663	0.880
Colombia	15.353	12.959	1.185	Thailand	14.716	16.856	0.873
Ireland	25.137	22.029	1.141	Netherlands	21.232	24.358	0.872
Finland	21.705	19.250	1.128	Mauritius	16.963	19.808	0.856
Indonesia	13.649	12.188	1.120	Paraguay	13.386	15.746	0.850
Chile	17.226	15.398	1.119	Spain	14.679	17.919	0.819
Tunisia	19.405	17.362	1.118	India	9.825	11.994	0.819
Uruguay	17.979	16.088	1.118	Japan	12.332	15.553	0.793
Sierra Leone	8.509	7.808	1.090	Dominican Rep.	13.311	16.902	0.788
Cameroon	13.965	12.817	1.090	Korea	14.068	18.376	0.766
Venezuela	15.205	14.057	1.082	Costa Rica	13.7895	18.2061	0.7574
Iceland	24.200	22.400	1.080	Guatemala	11.1054	15.1309	0.7340
Portugal	21.158	19.718	1.073	United States	10.8316	15.2702	0.7093
Zambia	15.035	14.192	1.059	Germany	11.2421	16.9437	0.6635
Brazil	14.437	13.803	1.046	Canada	13.2421	20.5320	0.6450
Bolivia	14.930	14.305	1.044	Iran	7.5526	12.9470	0.5833
Romania	17.342	16.688	1.039	Switzerland	9.4316	19.3840	0.4866
Ghana	13.667	13.454	1.016				

Full Sample Average Values: 17.09 (Actual); 16.59 (Fitted)

Notes: * Total Tax Revenue / GDP

** Derived from equation 6, Cross Section estimates results in Table 4.

Policy Implications

For countries with a weak tax effort, the policy implications are clear. Every effort needs to be made to expand the tax base and to apply and enforce rates of tax which bring more yield consistent with the traditional canons of taxation: equity, efficiency and administrative convenience. In many developing countries, the tax system is neither equitable nor efficient, and is administratively cumbersome. Avoidance (legal) and evasion (illegal) are rife. Equity requires a comprehensive definition of income and non-discrimination between income sources. A major deficiency of tax systems all over the world, and particularly in developing countries, is that there is no single comprehensive tax on all income. Typically there is a 'cedular' system with separate taxes on different sources of income. Wage and salary earners tend to be discriminated against vis-à-vis both owners of capital and property, and against the self-employed such as professional people and small-traders. An equitable system should also be such that it discourages luxury consumption and makes it difficult to avoid and evade taxation.

Taxable capacity is not measured by income alone, but also by wealth. Equity therefore also requires the taxation of wealth. A major deficiency of the tax system of many developing countries is the anonymity of wealth ownership, which precludes taxing wealth.

These observations and beliefs were common features of the tax advice that the famous Cambridge economist, Nicholas Kaldor, gave to all the developing countries that he advised between 1956 and 1976¹⁰, which led to five major recommendations for most countries. First that all income (including capital gains) should be aggregated and taxed in the same way, at a progressive rate, but not exceeding a top marginal rate of 50 percent. Secondly, there should be a progressive expenditure tax levied on rich individuals imposed where income tax leaves off. Thirdly, the imposition of a wealth tax. Fourthly, the introduction of a gifts tax. And lastly, the simplification of corporation tax to be imposed at a single rate. Above all, the entire tax system should be self-reinforcing and self-checking. Every taxpayer would have a code number and all property transfers would have to disclose the code number of the transferer and transferee. By this system, attempts by a taxpayer to avoid one tax would increase the liability for another, and the attempt of one party to conceal a

¹⁰ The countries include India (1956); Ceylon (now Sri Lanka)(1958); Mexico (1960); Ghana (1961); British Guiana (now Guyana)(1962); Turkey(1963); Iran(1966); Venezuela(1976).

transfer would increase the tax liability of the other party. In addition, to tackle tax evasion and avoidance, Kaldor recommended the training of a *corps d'elite* of highly paid tax officials (on French lines) immune from the temptation of bribes, deriving instead pride and satisfaction from their social status as highly paid state officials. All these Kaldor recommendations are as relevant today as they were when Kaldor was giving advice to developing countries over fifty years ago. Individual countries, of course, need to decide where their own priorities lie.

Most of Kaldor's advice, however, related to income and wealth taxes. Much less was said about trade taxes and taxes on different sectors of an economy. Many countries today raise as much tax revenue from trade taxes as they do from income tax. With regard to trade, import taxes are to be preferred to export taxes which can reduce the incentive to produce. Import taxes, or tariffs, have the merit of not only raising revenue, but can also be used as a means of domestic protection or potential import substitution. Luxury imports should be taxed the highest not only because they are generally more price inelastic and will raise the most revenue, but also because they are egalitarian by taking proportionately more tax from the rich than the poor. Import taxes can also be applied further down the value chain by identifying imports that could easily be produced domestically with limited protection; for example, types of food imports or processed raw materials.

Taxes raised from different sectors of the economy – agriculture, mining, manufacturing and services – relate largely to the taxation of profits. Multinational corporations are notorious for avoiding tax by transfer pricing and the over-invoicing of imported inputs; also by the repatriation of profits. Greater surveillance and regulation of multinational corporations is required. Taxes on agriculture are difficult to apply without affecting the incentive to produce, but the taxation of unused or under-utilised land should be considered to raise revenue, and also as an incentive for greater land utilisation. Kaldor (1980) recommended a tax on the productive potential of land in many of the countries he advised, although it was invariably rejected by powerful vested interests.

Adrian Wood (2008), the Oxford economist, has suggested an ingenious scheme for raising more tax revenue by linking international aid to tax effort. For every extra dollar raised in tax, donors would collectively agree to give fifty cents extra in aid up to a fifty percent upper limit of the ratio of aid to taxation.

This would give a strong incentive for countries with an aid to tax ratio below that limit to raise more taxation.

All countries, especially developing countries, need tax revenue to provide public goods with positive externalities, and for social expenditure. Without public expenditure on health, education and infrastructure, the development process is thwarted. Kaldor's advice to developing countries was often ignored, but he was unapologetic. At the end of his book of Essays on tax advice to developing countries (Kaldor, 1980) he concludes rather dramatically: 'Progressive taxation is, in the end, the only alternative to complete expropriation through violent revolution'.

Bibliography

- Bahl, R.W. (1971) 'A Regression Approach to Tax Effort and Tax Ratio Analysis' *IMF Staff Papers*, 18(3): 570-608.
- Bird, R.M. (1976) 'Assessing Tax performance in Developing Countries: A Critical Review of the Literature' *Finanzarchiv* 34(2): 244-265.
- Bird, R.M., Martinez-Vasques, J., Torgler, B. (2004). 'Societal Institutions and Tax Effort in Developing Countries', Working Paper 04-06, Andrew Young School of Policy Studies, Georgia State University, (1-49).
- (2008). 'Tax Effort in Developing Countries and High income Countries: The Impact of Corruption, Voice and Accountability', *Economic Analysis and Policy*, 38 (?): 55-71.
- Canavire-Bacarreza, G., Martinez-Vazquez, J. and Vulovic, V. (2013), 'Taxation and Economic Growth in Latin America', Inter-American Development Bank (IDB).
- Chelliah, R.J. (1971) 'Trends in Taxation in Developing Countries' *IMF Staff Papers* 18(2): 254-331.
- Chelliah, R.J., H.J.Bass and M.R. Kelley (1975) 'Tax Ratios and Tax Effort in Developing Countries 1969-1971', *IMF Staff Papers* 22(1): 187-205.
- Cody, D. (2018) 'Creating Fiscal Space', *Finance and Development* 55(4): 23-28.
- Dahlby, B. and Wilson, L.S. (1994). 'Fiscal Capacity, Tax Effort, and Optimal Equalization Grants', *Canadian Journal of Economics*, 27 (3): 659-672.
- Easterly, W. and Rebelo, S. (1993), 'Marginal Income Tax Rates and Economic Growth in Developing Countries', *European Economic Review* 37,
- Gupta, A.S. (2007) 'Determinants of Tax Revenue Effort in Developing Countries' IMF Working Paper WP/07/1184 (Washington DC: IMF).
- IMF (2011) 'Revenue Mobilisation in Developing Countries' Fiscal Affairs Division of the IMF (Washington DC: IMF).
- Kaldor, N. (1963) 'Will Underdeveloped Countries Learn to Tax?' *Foreign Affairs*: 410-419.
- Kaldor, N. (1980) *Reports on Taxation 11* (London: Duckworth).
- Lewis, A.W. (1966) *Development Planning* (London: George, Allen and Unwin)

Lotz, J.R. and E.Morss (1967) 'Measuring Tax Effort in Developing Countries' *IMF Staff Papers* 14(4): 478-497.

Moore, M., Prichard, W. and O-H. Fjeldstad (2018) *Taxing Africa* (London: Zed Books).

Nantob, N'Yilimon (2015) 'Taxes and Economic Growth in Developing Countries: A Dynamic Panel Approach'. MPRA – Munich Personal RePec Archive, No. 61346: 1 -23.

Piancastelli, M. (2001) 'Measuring Tax Effort of Developed and Developing Countries: Cross Country Panel Data Analysis 1985/95' IPEA (Brazil).

Shin, K. (1969) 'International Differences in Tax Revenue' *Review of Economics and Statistics*, 51(2): 213-230.

Tait, A., W.Gratz, and B. Eichengreen (1979) 'International Comparison of Taxation for Selected Developing Countries 1972-76' *IMF Staff Papers*, 21(1): 123-156.

Thirlwall, A.P. (1987) *Nicholas Kaldor* (New York: New York University Press).

Wood, A. (2008) 'How Donors Should Cap Aid to Africa' *Financial Times*, 14 September.

Zee, H.H. (1996) 'Empirics of Cross Country Tax Revenue Comparisons' *World Development*, 24(10):1659-1671.

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