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Estimating Tax Progressivity in Developing Countries: The Plato Index

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Abstract:
Progressive direct taxation is necessary to complement social protection, in order to reduce income inequality as well as poverty. A new metric of personal income tax incidence progressivity (the 'Plato Index') is presented, using WIDER databases for income inequality (WIID) and tax revenues (GDR). Taxation is shown to be far less progressive in developing countries, than in developed ones (particularly Europe) although there are large variations within regional and income groups. There is significant correlation of direct tax progressivity not only with the level of economic development, but also with health and education provision. Both findings imply potential policy space for higher personal income tax pressure.

JEL: D12, H23, I32, O15
Keywords: direct taxation, tax progressivity, developing countries, fiscal incidence, social protection

Introduction

> *"When there is an income tax, the just man will pay more and the unjust less on the same amount of income." (*The Republic*, book I, 343-D).*

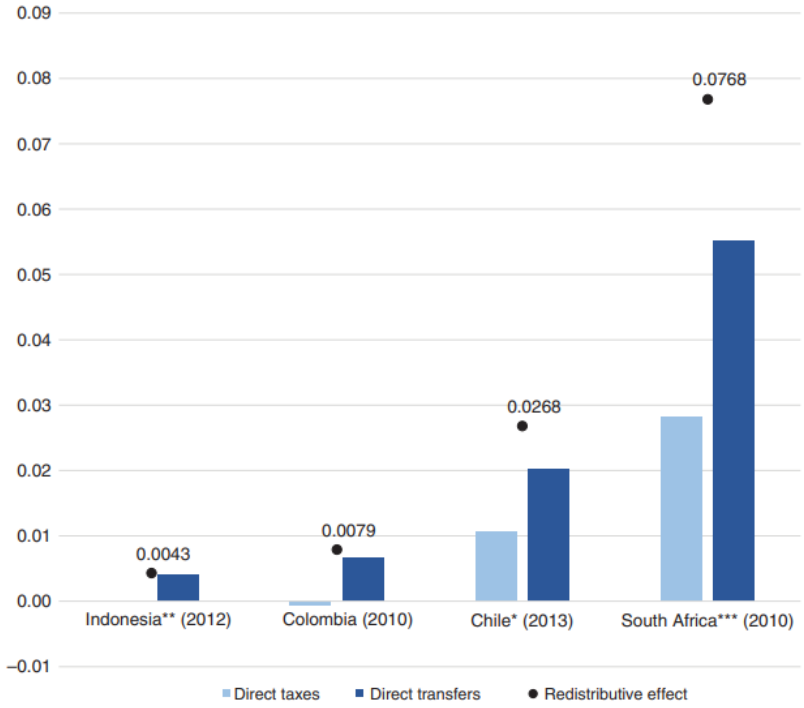
Effective rates of direct taxation (i.e. the proportion of income actually paid in direct taxes) on higher income groups in developing countries are low by international standards; as a proportion of GDP they are about half of those in developed countries. This has serious implications for both revenue (and thus ability to provide social protection to the majority of the population) and inequality.

Over the past decade this fiscal orthodoxy has been increasingly contested as the focus has shifted from poverty towards inequality, and from targeted safety nets towards more universal social protection.[1] Both these shifts imply a greater role for direct taxation, as both a source of funds and in mitigation of inequality in disposable income. In recent years, a variety of research and indicators by academics, international and non-governmental organisations has attempted to address these shifts and for example, Oxfam proposed to use the Commitment to Reducing Inequality Index (Martin et al, 2020), which includes a progressive tax pillar, to monitor policy commitments to reduce inequality in the time of COVID-19. Among these efforts, the most comprehensive international research project on fiscal redistribution (the Commitment to Equity Project, CEQ, at Tulane University: Lustig and Higgins, 2013; Lustig, 2018) has now begun to analyse household surveys with a view to determining tax and benefit incidence in a similar manner. The project has produced extremely valuable and detailed estimates of the incidence of both taxes and expenditures which (see Figure 1 below) clearly indicate that direct taxation has a redistributive effect of a similar order of magnitude to direct transfers in developing

[1] SDG 10, 'Reduce inequality within and among countries', includes targets 10.1, to 'progressively achieve and sustain income growth of the bottom 40 per cent of the population at a rate higher than the national average', and 10.4, to 'Adopt policies, especially fiscal, wage and social protection policies, and progressively achieve greater equality'. Under SDG 17, 'Strengthen the means of implementation', the first area is finance and the leading target addresses domestic resource mobilisation.

countries; even though their combined effect is relatively small (less than 3 percentage points of the Gini index, compared to 17 points for Europe).

Figure 1. Redistributive effect from market to disposable income



Source: Lustig (2016) (Figure 9, Panel A)

Notes: Marginal contribution of taxes and transfers (circa 2010): pensions and market income. Ranked by marginal contribution of direct transfers.

The progressivity of the tax system as a whole (or its individual components) measured in this way is also known as the 'Kakwani index' – defined as the Gini concentration index for the taxes collected minus the Gini index for pre-tax incomes (Kakwani, 1977). This can be shown to be equal to the absolute decline in the Gini index for incomes, caused by the imposition of taxation, divided by the average net rate of taxes (Bracewell-Milnes, 1979). This also illustrates the more general point (Kakwani, 1977) that the redistributive effect of direct taxation depends not only on the progressivity of the direct tax schedule itself but also on its average level. However, the CEQ approach – while clearly the 'gold standard' has three practical limitations: first, it is costly in terms of money, time and effort; second, it has only been carried out so far

for a small number of countries and years; and third, it so far covers mainly middle-income countries.[2]

Unfortunately, despite this recent progress in estimating fiscal incidence with household surveys in developing countries, these exercises are costly in terms of both time and money, and so tend to be available for only a few countries and a few years. Researchers and policymakers thus still lack a robust and usable metric for tax progressivity derived from existing international databases which can be applied in a macroeconomic and comparative context. Moreover, international comparisons of tax burdens that inform discussions of tax policy, however, always use GDP as the denominator. Thus the distributional incidence ('progressivity') is not compared, nor is the effective income base for direct taxation identified. In fact, few developing countries have official tax incidence statistics, nor do international organisations address this issue systematically.

This difficulty is not due to the lack of household data on tax incidence alone: in fact it has been exacerbated by the weaknesses in existing international tax datasets, which have also meant that earlier cross-section and time series findings on the relationship between direct taxation and economic development have probably been misleading.[3] The construction of the new Government Revenue Dataset for the International Centre for Tax and Development, now hosted by UNU-WIDER, has allowed a more comprehensive and detailed picture of fiscal revenues in developing countries than that traditionally provided by the IMF, and in particular of the direct tax revenues (ICTD/UNU-WIDER, 2016). This is a major step forward, and if a simple yet robust measure of the direct tax base were available for many developing countries over a sufficient time period, then direct tax incidence would be widely measurable.

[2] At July 2016, CEQ http://www.commitmentoequity.org/ lists 21 countries as having had studies completed so far: Argentina; Armenia; Bolivia; Brazil; Chile; Colombia; Costa Rica; Ecuador; El Salvador; Ethiopia; Ghana; Guatemala; Indonesia; Iran; Mexico; Paraguay; Peru; South Africa; Tanzania; Uruguay; and the United States. Of these, studies for three countries are not currently available (Armenia, Chile and Indonesia). A further 16 countries are listed as 'in progress': China; Dominican Republic; Egypt; Georgia; Honduras; India; Jordan; Mozambique; Nicaragua; Russia; Sri Lanka; Togo; Tunisia; Turkey; Uganda; Venezuela; and Zambia. In addition, it may be hoped that national statistical authorities take up the task directly in at least some cases.

[3] Prichard et al., 2018; Clist, 2014

Accordingly, this paper aims to establish an appropriate macroeconomic indicator, to provide preliminary estimates and explore their implications. The paper proceeds as follows. The next section sets out the intuition and metrics behind the proposed 'Plato Index': a simple measure of direct tax incidence (pressure and progressivity), derived from the data that do exist with sufficient coverage and quality. This section also explains the data used for the various components of the analysis. The numerical results are presented in Section 3, which offers some preliminary observations on comparisons between developing countries (and regions) on the one hand; and trends over time on the other. Some econometric tests on the relationships between direct tax progressivity, social protection and economic development are presented in Section 4. The paper concludes by locating these preliminary findings in the context of current policy debates about inequality in developing countries, and suggests what the relationship between tax progressivity and social protection might imply for both governments and the international community.

Estimating the Plato Index

Our objective is to create a metric of tax progressivity which does a similar job to the Kakwani index, but which has three characteristics, namely that it:

a) reflects as far as possible at the aggregate national level the concepts of the microeconomic, household-level tax incidence;
b) is based on available databases for aggregate national data; and hence
c) covers a large number of developing countries and a considerable time period.

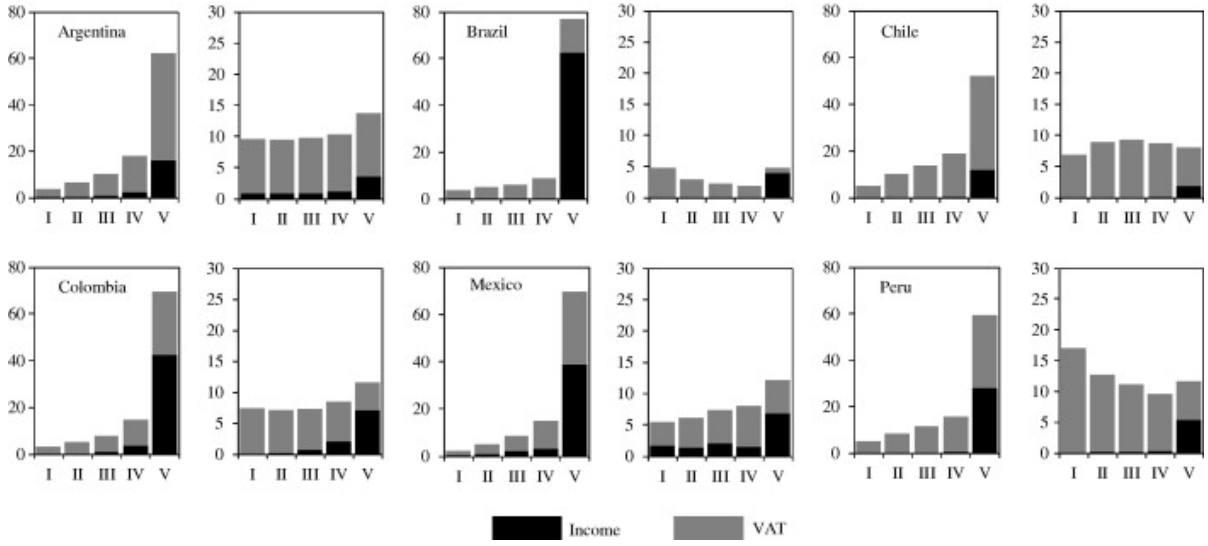
The panel dataset used for our tax data is derived mainly from the combination of the new ICTD/UNU-WIDER Government Revenue Dataset (GRD) and the UNU-WIDER World Income Distribution Database (WIID).

To undertake this task, we take advantage of the fact that in developing countries by far the greater part of direct income tax is paid by the top quintile of the population. Figure 2 below shows World Bank estimates for Latin America which show this very clearly. Less systematic data for other regions show similar figures – for instance 95% for South Africa in the CEQ study (which also derives 80% for both Brazil and Mexico). This would include capitalists and

professionals, much of the upper middle class; and in developing countries most of those with skilled, stable jobs in the 'modern' sector.

Figure 2 also foreshadows a central theme of this paper: the relatively low levels of tax pressure on this quintile – ranging from 5 to 10 percent of income. A brief comparison with the UK's Office for National Statistics' data is illustrative in this respect: first, the proportion of total income tax paid by the top quintile is lower (about 60 percent); and second, the direct tax pressure on the top quintile is much higher – 24 percent.

Figure 2. Taxation by income quintiles



Source: Goñi, López, and Servén (2011) (Figure 8)

Notes: Panels on the left are expressed as percentage of total contribution of all quintiles; panels on the right are expressed as percentage of the total gross income of each quintile.

Our definition of the Plato Index is simple and tractable: *the ratio of total direct personal tax revenue to the aggregate disposable income of the top quintile of households.* This ratio (π) corresponds to the major characteristic of tax progressivity (or lack thereof) discussed above, and as will be shown below is relatively simple to estimate for a large number of countries over long periods. The numerator (T_p) is self-explanatory. Household disposable income (Z) is household income as measured post-direct tax (HY) plus direct taxation, and we are concerned here with the top quintile (α) of households; so that:

$$\pi = \frac{T_p}{Z_\alpha} = \frac{T_p}{HY_\alpha + T_p}$$

The GRD combines all major existing global and regional sources of national-level revenue data, including e.g. the IMF's Government Financial Statistics. Important innovations include the careful construction of consistent GDP series, and the introduction of data from individual IMF country studies and Article IV reports (see Prichard, Goodall & Cobham 2014, for details).[4] We use the second, August 2015 version of the GRD, which covers 211 countries, with entries as far back as 1980 and up to 2013 (a maximum of 34 years). The major – but unavoidable – weakness, in terms of Plato Index construction, lies in inconsistent and sporadic social security coverage.

As personal direct tax revenue (T_p) we use the GRD data on the non-corporate direct tax paid (including social security payments). Specifically, we use a sum of direct taxes on individuals and social contributions, expressed as percentages of GDP. According to Prichard, Goodall & Cobham (2014), the direct taxes on individuals do not include property taxes and taxes on corporations, but do include the rest of direct taxes on incomes, profits and capital gains.

To increase the country and year coverage, we include observations also when only data on direct taxes on individuals are available and when data on social security payments are not available, treating the letter as zeros. This could lead to a downward bias in the Plato index for these observations relative to other country and year observations, but we believe that the improved coverage outweighs the likely scale of this issue. Also, in some cases (the extent of which the available data does not enable us to identify), the social contributions might accurately be absent – that is, reflecting a non-existent social contributions system. In these cases, there is no risk of a downward bias in the Plato index.

[4] In 2015, following publication of the GRD, the IMF Fiscal Affairs Department published a version of its researchers' own composite dataset, the World Revenue Longitudinal Data (WoRLD). A working paper scheduled to follow is not yet available, but examination of the available data has shown major limitations. Not only is WoRLD coverage substantially smaller than that of the GRD, and significant categories such as 'non-tax revenue' absent; but most importantly, the WoRLD data has been shown to contain multiple important errors, many likely to be due to the WoRLD reliance on a simple algorithm to choose between different datasets (McNabb, 2018).

For income distribution we use the WIID, version 3.0b (September 2014), which covers 179 countries up to 2012 and, in some cases, back to before 1960, and is superior to alternative sources in terms of quality and coverage (Jenkins, 2015). UNU-WIDER (2014) notes that the inequality indices reported are in the first place those calculated on the basis of disposable income, although indices based on earnings or gross incomes are reported as well if they are available.

WIID often offers multiple estimates for country-year pairs. We have used the following method of choosing among them. First of all we discard those that do not cover the whole population, all age cohorts or the whole area. When we have more observations for a country in a given year, we use the observation with a highest value of a quality indicator designed by the WIID. If we are still left with multiple observations, we use the one that has the highest value of the top income quintile, which is in general likely to be under-reported (which might be due to, for example, hidden income flowing abroad or survey non-response – see discussion in Cobham, Schlogl & Sumner, 2015). When data on income distribution are not available from the WIID, we complement them from the WDI. Specifically, in around two hundred country-year observations we input the WDI series of "Income share held by highest 20%: SI.DST.05TH.20"' when the WIID information is missing.

This gives us the share (*A*) of the top quintile of households in total household income (HY):

$$A = \frac{HY_\alpha}{HY}$$

From which of course

$$HY_\alpha = A.HY$$

Our source for national accounts data, the World Development Indicators (WDI), is the primary World Bank collection of development indicators, compiled from officially-recognized international sources. It claims to present the most current and accurate global development data available, and includes information on various topics ranging from social development to infrastructure for up to 214 economies. We employ the database as downloaded on 17 September 2015. The WDI does report Household Final Consumption Expenditure (as % of GDP)

(NE.CON.PETC.ZS). HFCE (formerly 'private consumption') is defined as the market value of all goods and services, including durables purchased by households. It excludes purchases of dwellings but includes imputed rent for owner-occupied dwellings. It also includes payments and fees to governments to obtain permits and licenses; but includes expenditures of nonprofit institutions. There are two sources of concern here: first, this definition excludes savings which is critical for our top quintile, which undertakes most of household savings; and second this item also includes "any statistical discrepancy in the use of resources relative to the supply of resources" (i.e. all the errors in the other components of national income). To address the first problem, we considered attributing all household savings to the top quintile in order to re-estimate this group's aggregate income but to do this we would have to subtract government savings and corporate savings from total domestic savings, with no data sources for these. The second problem has no obvious solution.

In consequence, we have decided to estimate the aggregate income of top quintile as their share of household income (post-tax) applied to GDP as a whole (*Y*). This would imply a proportionate share of all the components of national income other than household income (principally corporate income assuming fiscal balance) and is more likely to be an underestimate than otherwise.

This gives us the following *operational* definition for the estimation of the Plato Index

$$\pi = \frac{T_p}{Z_\alpha} = \frac{T_p}{A.Y + T_p}$$

The results for the Plato Index cover just 5 countries in 1970, a maximum of 58 countries in 2008 and 14 countries in 2012. Coverage is relatively high for household incomes (a maximum of 181 countries between 2002 and 2005), but quite low for both direct tax paid by individuals

(a maximum of 80 countries in 2006, 65 in 2012, 38 in 2013) and the income share of the top quintile (a maximum of 85 countries in 2010 and as few as 30 in 2012 and zero in 2013).

Due to this variation, we carry out two extrapolations to improve the country coverage for cross-country comparison. First, we bring forward the most recent value of the Plato index and this results in country coverage of 85. Second, we bring forward the most recent values of all the indicators that are inputs for the Plato index and estimate the index on the basis of these extrapolated values. This second extrapolation achieves the maximum country coverage of 94. Both of these extrapolations require the strong assumption that the indicators do not change substantially over time. We can see from the available time series data that this assumption does not hold in a number of cases. Nonetheless we present the results in the interest of investigating the cross-country dimension. We considered more complex extrapolations such as those based on recent trends in the data, but we decided against them because of the further assumptions necessary, for which we do not have supporting data. We thus use only the simple extrapolations based on bringing forward the most recent values.

Plato Index results

In this section of the paper, we present the main statistical results for the Plato Index; before proceeding to an initial econometric exploration in the next. We employ the World Bank's classification of countries by region and income groups, valid as of July 2015.[5]

The main characteristics of these results are three:

- The combination of taxation and distribution data yields a meaningful indicator with a wide range of values reflecting variations in both components
- Countries with higher levels of development (reflected in per capita gdp) have higher Plato Index values, reflecting greater tax progressivity

[5] Per http://data.worldbank.org/news/new-country-classifications-2015, as of 1 July 2015, low-income economies are defined as those with a GNI per capita, calculated using the World Bank Atlas method, of $1,045 or less in 2014; middle-income economies are those with a GNI per capita of more than $1,045 but less than $12,736; high-income economies are those with a GNI per capita of $12,736 or more. Lower-middle-income and upper-middle-income economies are separated at a GNI per capita of $4,125.

- However, within income groups and within regions there are wide variations in the Index value, which are probably related to other political economy drivers.

Table 1 shows the (unweighted) means and ranges for the 94 countries covered. It is clear that broadly speaking the Index value rises with the level of income but there are also clear regional differences, while the range within each region and income group is quite large. In particular, tax progressivity in non-OECD high income and upper middle income countries is only half of that in OECD countries. These are countries with well organised economies and competent administrations, so political choice is a clear driver. In contrast, lower-middle income countries have tax progressivity at only a quarter the OECD level; where administrative shortcomings (themselves a political choice, of course) are probably predominant. [6]

Overall, per capita income appears to explain most of the variation in the Index value. However, when we disaggregate into income groups, the correlation with income is sharply reduced within each group. This has two implications: on the one hand, that within each economic development level, some countries are able to maintain far more progressive tax systems than others; and one the other, that per capita income differences between groups are actually a proxy for other structural or organisational differences.

Table 1. Values of the Plato index for the latest year available by regions and income groups

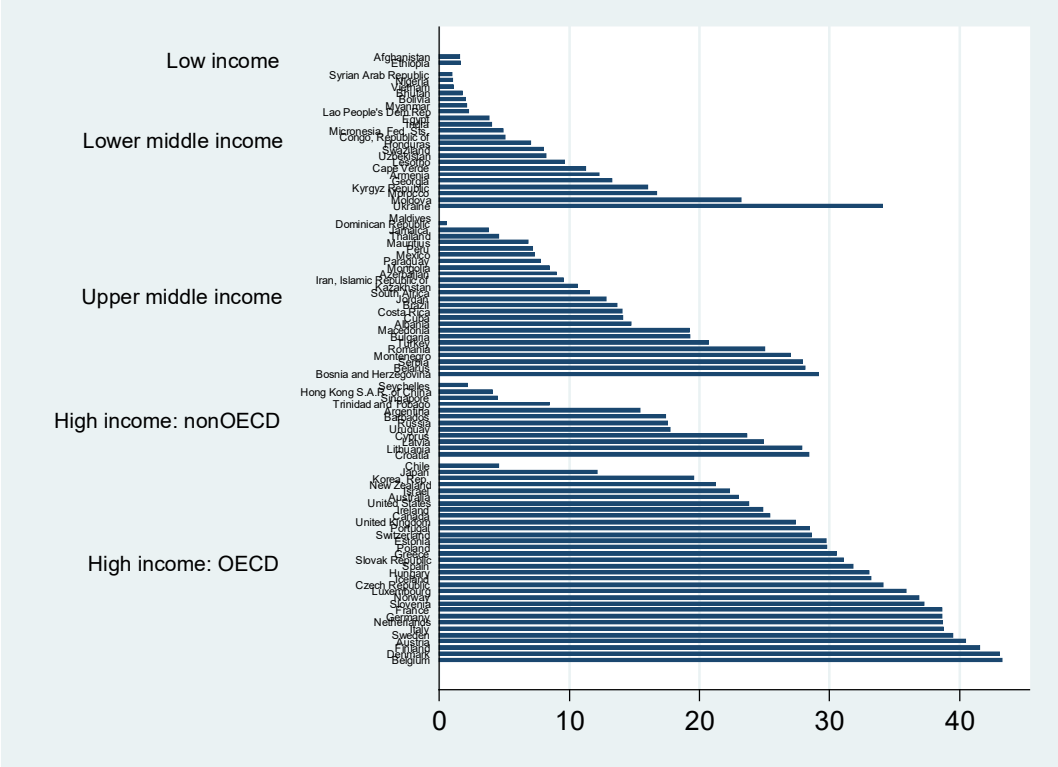
	Number of countries	Mean	Min	Max	Standard deviation	Correlation with GDP per capita
All countries	94	18.4	0	43.3	12.7	0.6116
East Asia & Pacific	12	9	1.1	23.1	8	0.6229
Europe & Central Asia	46	28.2	8.2	43.3	9.4	0.6096
Latin America & Caribbean	15	9.4	0.6	17.7	5.6	0.5616
Middle East & North Africa	6	11	1	22.3	8	0.7229
North America	2	24.6	23.8	25.5	1.2	-1.0000
South Asia	4	1.8	0	4	1.7	-0.7007

[6] There are too few low income countries as yet in the sample to make a judgement on these – currently, only Afghanistan and Ethiopia.

Sub-Saharan Africa	9	6.4	1	11.5	4.1	-0.1491
High income: OECD	32	30.9	4.6	43.3	9	0.2760
High income: nonOECD	12	16	2.2	28.4	9.3	-0.5109
Low income	2	1.6	1.5	1.7	0.1	-1.0000
Lower middle income	22	8.6	1	34	8.3	0.1749
Upper middle income	26	13.6	0	29.2	8.6	0.0513

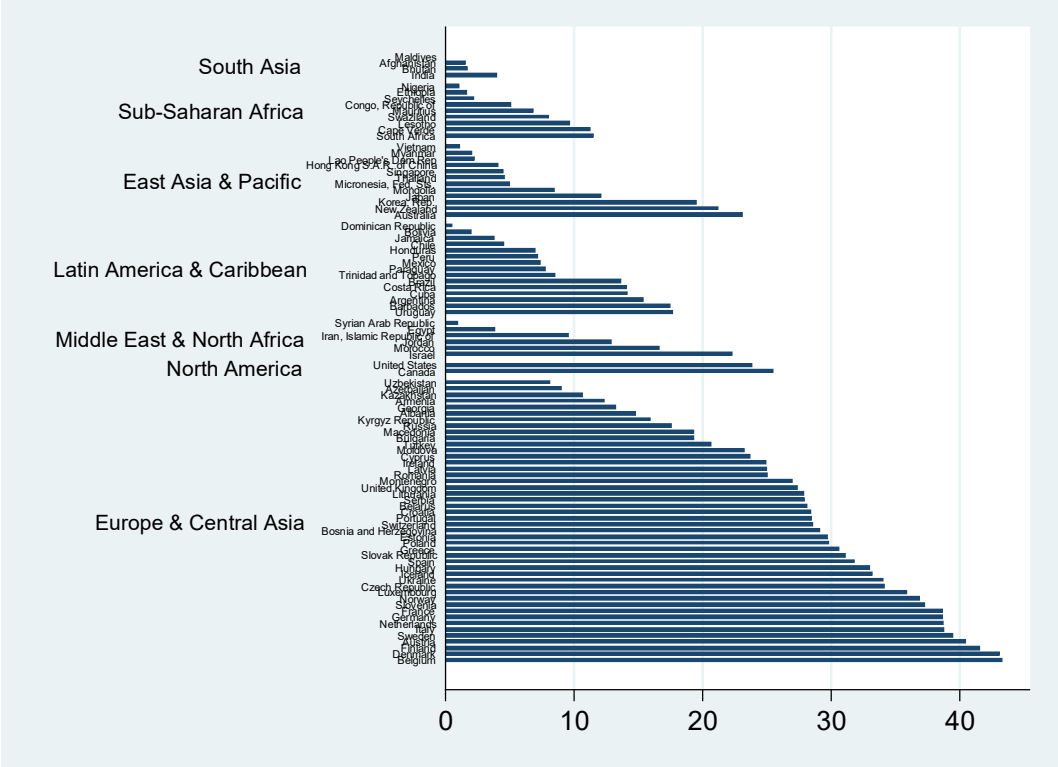
Figures 3 and 4 show this data on a country-by country basis for the latest year available. These figures illustrate very clearly the wide variations in tax progressivity within income groups and regions. In Figure 3 for instance, among lower middle income countries those with a socialist heritage have Index values similar to those of the OECD as might be expected; but others such as India and Egypt have values around 5 percent while Morocco is 15 percent – three times greater. Again, among the upper middle income group Thailand and Jamaica have very low values (less than 5 percent), and while again the ex-socialist countries have high OECD-type values, so also do Turkey, Costa Rica and Brazil. Indeed, within the OECD members, the wide range with most members falling within the 20-40% range also indicates major differences in redistributive strategy – with the major difference being between 'anglo'saxon' economies on the one hand and 'eurozone' ones on the other. Once again, these differences do not reflect levels of economic development or administrative capacity but rather political economy equilibria – that is the nature of the social contract.

Figure 3: Plato Index by income group and country



Within regions, as Figure 4 shows, there are similar variations despite similarities in administrative and political systems.

Figure 4: Plato Index by region and country



We can also use this data in order to explore changes over time. Poorer countries (Figure 5) do appear to be slowly raising their Index values over time; but middle income countries exhibit a process of convergence with about half rising and half falling (Figure 6). Upper income countries (Figure 7) exhibit little convergence and some signs of a downward trend.

Figure 5: Plato Index values over time, selected low- and lower-middle income countries

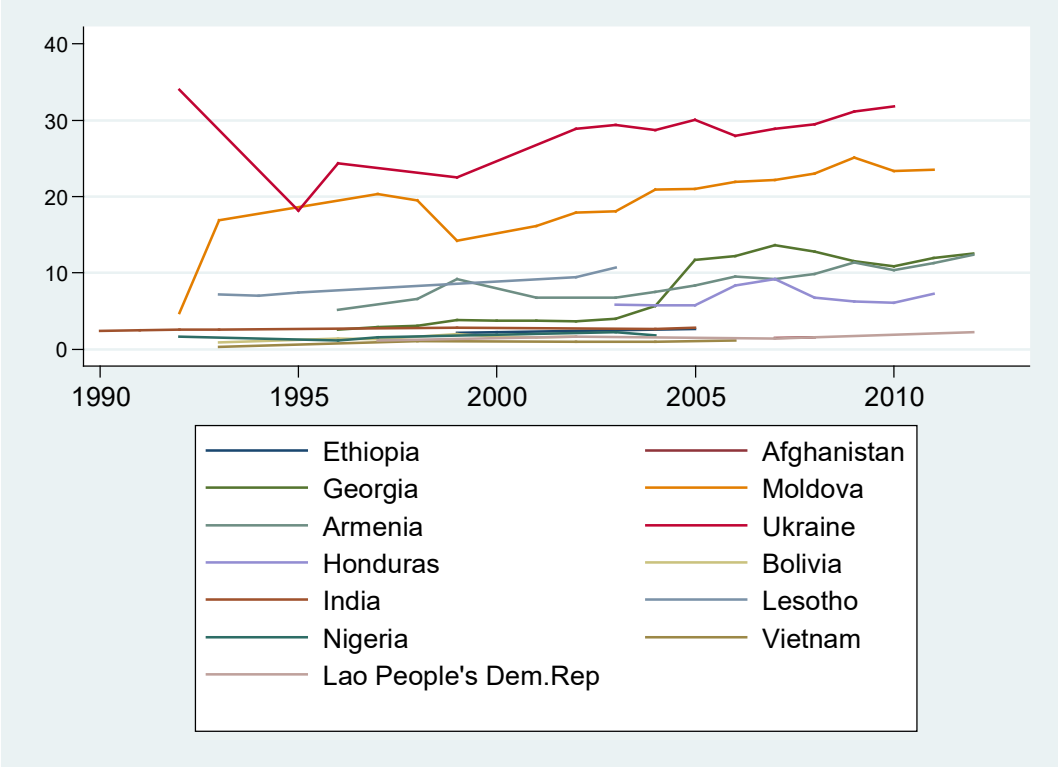


Figure 6: Plato Index values over time, selected upper-middle income countries

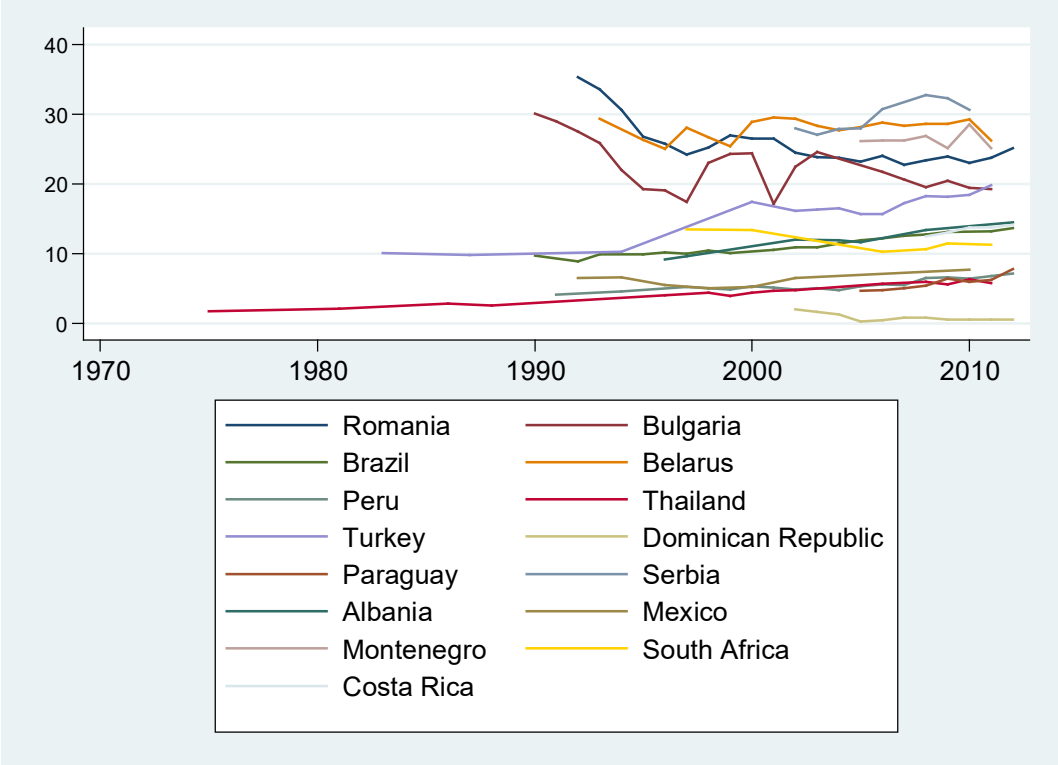
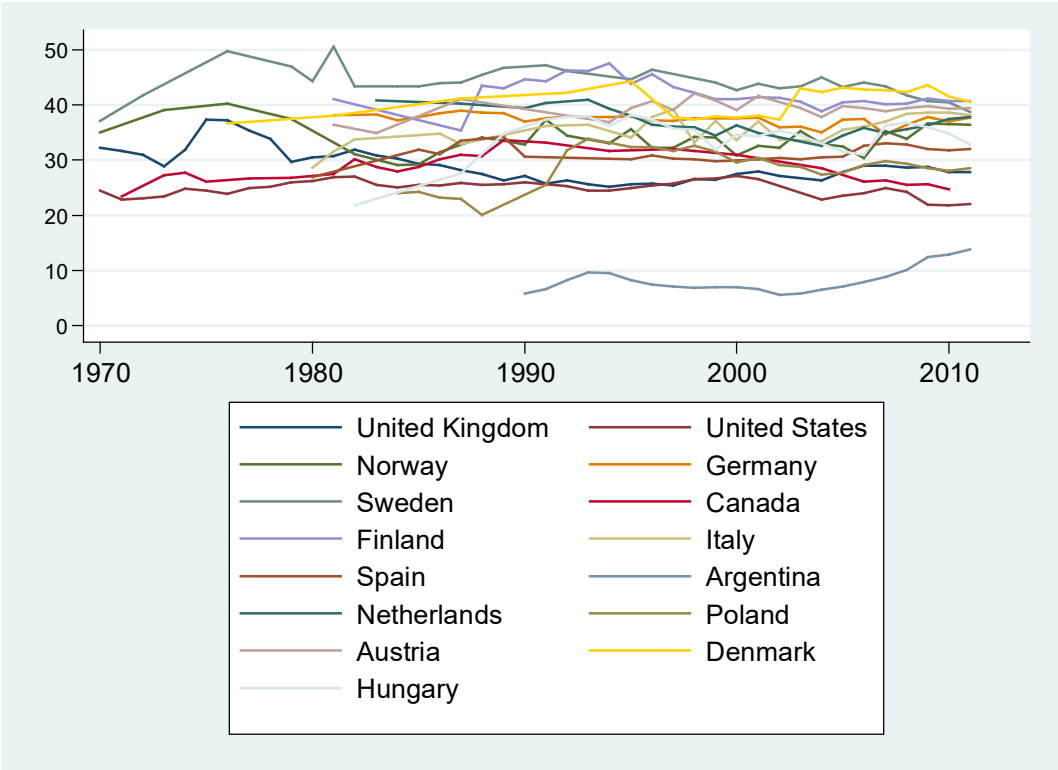


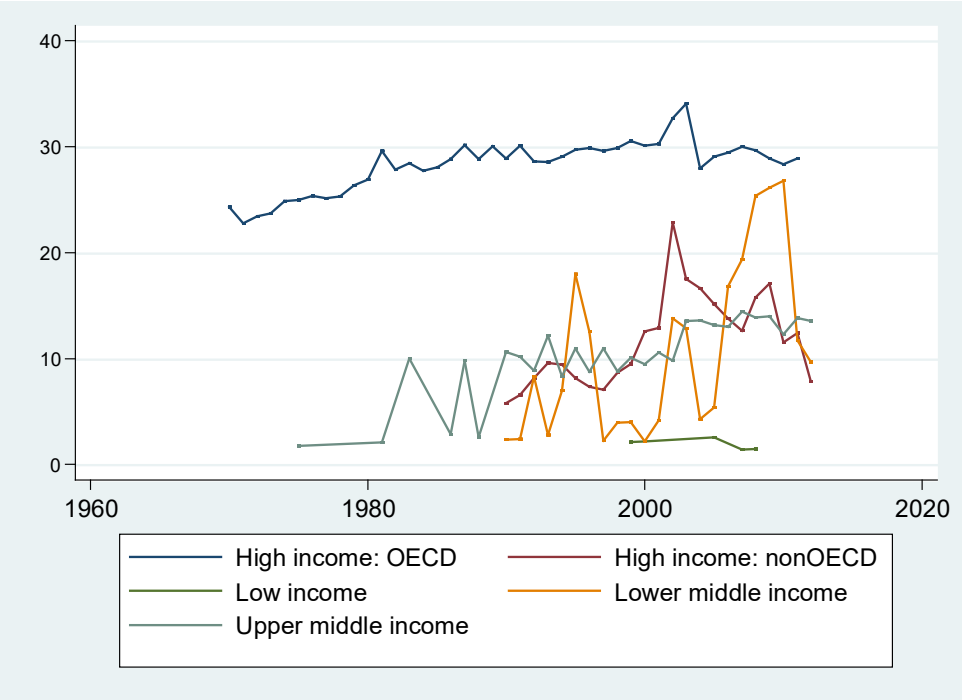
Figure 7: Plato Index values over time, selected high income countries



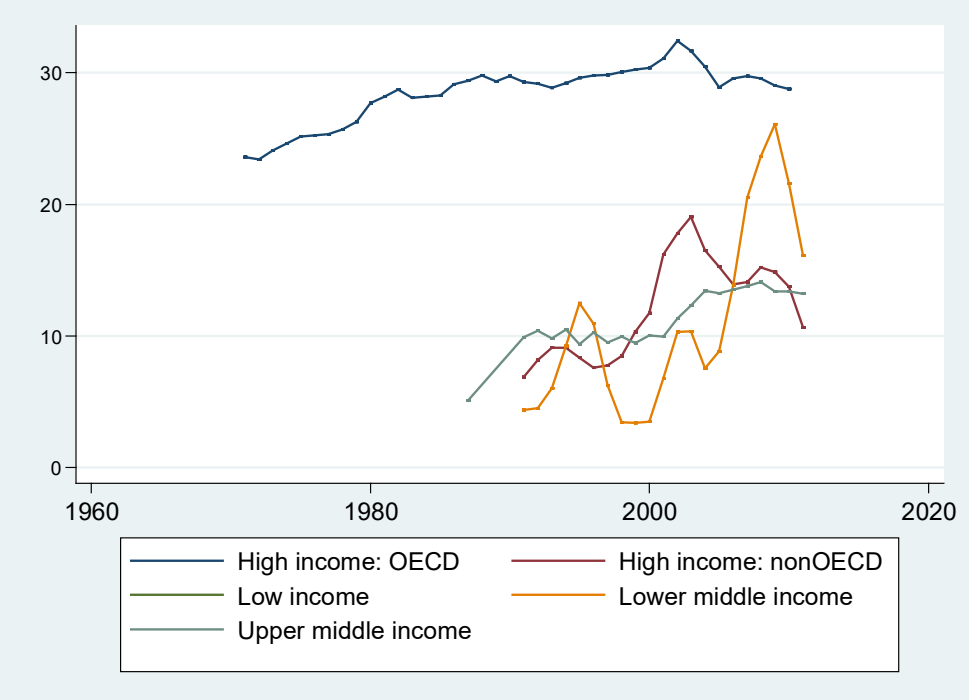
Finally, Figure 8 shows regional means weighted by country gdp. Two trends are worth noting: first, that in high income OECD ('developed') countries there was an increase in progressivity between the 1970s and 1990s, but that this subsequently stabilised and shows some signs of recent decline; second that allowing for noise, there is an upward trend in progressivity among developing over time, particularly among middle-income countries, and thus some convergence on developed countries.

Figure 8. Plato Index by regions, weighted by GDP (individual years, three- and five-year moving averages)

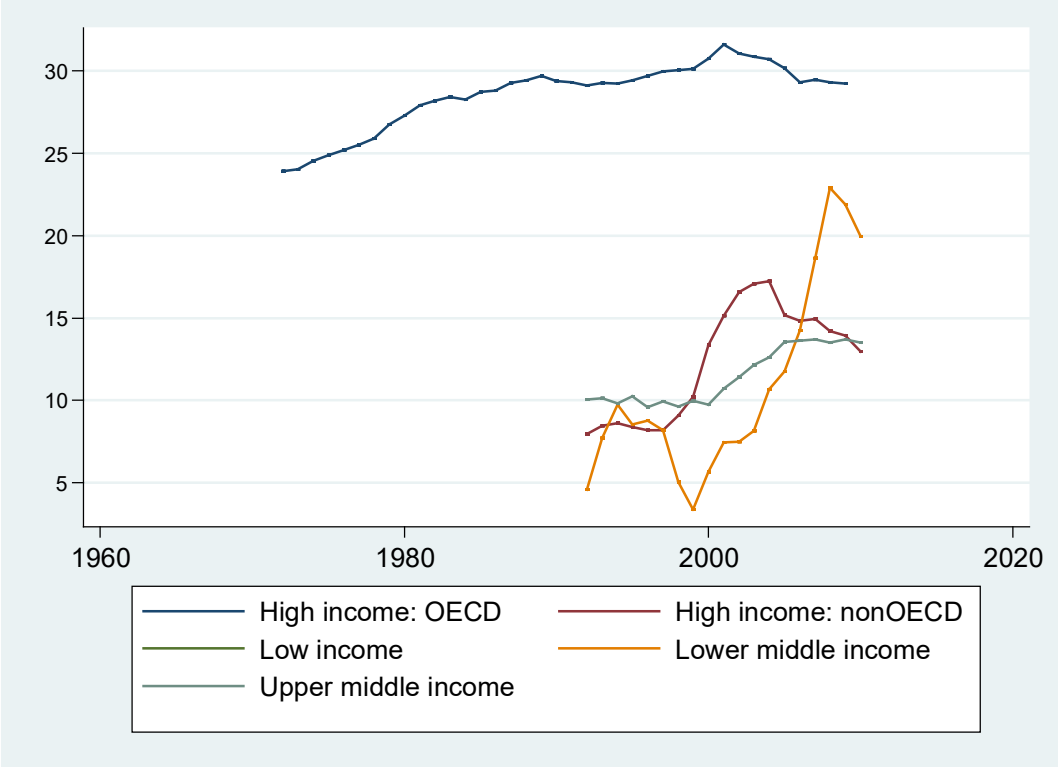
Individual years:



Three-year moving averages:



Five-year moving averages:



In sum, even allowing for different levels of economic development, there appear to exist a considerable space for a large number of countries to raise the progressivity of their tax systems so as to approximate to highest value in their reference group – whether this be by region or by income level.

Direct tax progressivity and social protection: some initial tests

As noted in the introduction to this paper, the reduction of inequality by fiscal means involves both progressive taxation and meaningful social protection. The traditional economists' position has been that the absence of tax progressivity can be compensated by increased fiscal transfers. An alternative political economy view would be that the drivers of both are similar. The former should imply no or negative correlation between tax progressivity and social protection; the latter would imply a positive correlation. In both cases, of course, the role of GDP per capita as a common determinant has to be taken into account.

We thus investigate whether countries with high values of the Plato index are better at social protection, independently of their per income capita level. In our empirical model we use secondary school enrolment (labelled *senrol* in the regression tables) and infant mortality

(*imort*) as the dependent variables – of which we consider the latter likely to provide a clearer, sharper single measure of basic, social conditions. We also provide additional results, where health expenditures (*health_gdp*) and education expenditures (*educ_gdp*), as shares of GDP, are the dependent variables.

In terms of the WDI data on social outcomes, we consider the following indicators of health: "Mortality rate, infant (per 1,000 live births): SP.DYN.IMRT.IN", "Mortality rate, neonatal (per 1,000 live births): SH.DYN.NMRT", "Mortality rate, under-5 (per 1,000 live births): SH.DYN.MORT", and the following indicators of schooling: "School enrollment, primary (% gross): SE.PRM.ENRR", "School enrollment, secondary (% gross): SE.SEC.ENRR", "School enrollment, tertiary (% gross): SE.TER.ENRR", "Secondary education, duration (years): SE.SEC.DURS". As the main indicators of social outcomes, we use the infant mortality rate and secondary school enrolment.

Furthermore, we use "GDP per capita (current US$): NY.GDP.PCAP.CD"' and, in addition to indicators of social outcomes, we consider public expenditures on health and education as a share of GDP or government expenditures: "Government expenditure on education, total (% of GDP): SE.XPD.TOTL.GD.ZS" and "Government expenditure on education, total (% of government expenditure): SE.XPD.TOTL.GB.ZS"; "Health expenditure, public (% of GDP): SH.XPD.PUBL.ZS" and "Health expenditure, public (% of government expenditure): SH.XPD.PUBL.GX.ZS".

As the main independent variables we use the Plato index (π) and GDP per capita (*gdppc*). Additionally, we deconstruct the Plato index into its two key components in order to see whether the income share of top quintile households (α) or direct taxes paid by individuals (t_p) as a share of GDP are the key driver of social outcomes.

We use fixed effects panel regressions because we are interested in the impact of variables that vary over time rather than country-specific characteristics, and this choice allows us to explore the relationship between dependent and independent variables within individual countries. It also removes the effect of time-invariant countries' characteristics and we thus focus on the

effect of the independent variables on the dependent variable. In addition, this decision is supported by statistical tests.[7]

As with any econometric analysis based on country-level data, ours has its limitations. The data availability is limited and the average number of years in the regressions is between 7 and 12, which is not very long from the point of view of health and education policy and their outcomes. Importantly, rather than trying to determine causal relationships between the variables, we are employing regressions to indicate whether there is a significant correlation between direct tax progressivity with health and education provision, over and above that with per capita income.

Tables 2 and 3 show results of 16 regressions, four with each of the four indicators of social outcomes as the dependent variable. The independent variables here are values of the Plato Index or of its components, together with per capita income in half of the regressions.

Table 4 shows a further set of regressions, in which we look at the correlations of the Plato index with income per capita as well as the health and education expenditures.

The main points arising from these results are as follows:

- As expected, there is a significant correlation of the Plato Index with per capita GDP, consistent with the view that more progressive tax regimes are likely to be adopted as incomes grow. This is a familiar result, but it is useful to see that this is confirmed and the model is robust.
- The two components of the index (α and t_p) both have significant effects on health and education, of the expected signs – indicating the value of the new Index.

[7] Hausman tests were employed, with the null hypothesis that the preferred model is random effects and the alternative is fixed effects. The p-values of the Hausman tests for the 16 regressions (with dependent variable of *educ_senrol*) point mostly to using fixed effects, i.e. at the 0.05 significance level, 13 of the 16 specifications reject the null hypothesis of random effects (0.0186, 0.0979, 0.0119, 0.3941, 0.1462, 0.3138, 0.0045, 0.0031, 0.0008, 0.0010, 0.0010, 0.0257, 0.0004, 0.0000, 0.0000, 0.0002).

- There is a significant correlation of the Plato Index as an independent variable with both education and health expenditures as a share of GDP, and persisting for health even when GDP per capita is included.
- Health and education as *shares* of the total budget do not appear to be significantly correlated with the Plato Index, which would tend to indicate that the effect is through the 'funding channel' discussed in the next section.

Treating the Index itself as a dependent variable in Table 4, again implies that higher health and education expenditures as a share of GDP are correlated with higher Plato values; and thus that the causation may run from social commitments to tax progressivity

Table 2: Regression results, education

Variables	(1) *senrol*	(2) *senrol*	(3) *senrol*	(4) *senrol*	(5) *educ_gdp*	(6) *educ_gdp*	(7) *educ_gdp*	(8) *educ_gdp*
α			-0.145	-0.0551			-0.0280***	-0.0231***
			(0.177)	(0.594)			(0.000585)	(0.00497)
T_p			0.653***	0.815***			0.0953***	0.110***
			(0.000535)	(3.43e-05)			(3.19e-09)	(0)
π	0.460***	0.404***			0.0746***	0.0765***		
	(0.000319)	(0.00154)			(0)	(0)		
gdppc		0.000286***		0.000300***		5.59e-06**		7.54e-06***
		(0)		(0)		(0.0177)		(0.00213)
Constant	82.25***	78.60***	90.43***	78.88***	3.032***	2.876***	4.715***	4.150***
	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Obs	931	912	931	912	762	756	762	756
R^2	0.015	0.118	0.017	0.127	0.070	0.080	0.072	0.086
Number of c_n	80	80	80	80	75	75	75	75

Notes: P-values are in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Table 3: Regression results, health

Variables	(9) imort	(10) imort	(11) imort	(12) Imort	(13) health_gdp	(14) health_gdp	(15) health_gdp	(16) health_gdp
α			0.199***	0.161***			-0.0414***	-0.0124
			(0.000234)	(0.00160)			(2.14e-06)	(0.110)
Tp			-0.574***	-0.632***			0.00927	0.0762***
			(1.20e-08)	(7.73e-10)			(0.670)	(9.72e-05)
π	-0.482***	-0.448***			0.0519***	0.0441***		
	(0)	(0)			(7.78e-05)	(0.000111)		
gdppc		-0.000178***		-0.000185***		3.82e-05***		3.97e-05***
		(0)		(0)		(0)		(0)
Constant	26.07***	28.22***	13.86***	19.42***	3.746***	3.214***	6.638***	3.727***
	(0)	(0)	(9.07e-07)	(0)	(0)	(0)	(0)	(0)
Obs	1,064	1,043	1,064	1,043	776	768	776	768
R2	0.052	0.173	0.049	0.179	0.022	0.274	0.033	0.280
Number of c_n	86	86	86	86	84	84	84	84

Notes: P-values are in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Table 4: Regression results, Plato Index

Variables	(17) π	(18) π	(19) π	(20) π	(21) π	(22) π	(23) π	(24) π	(25) π
gdppc	3.40e-07		-1.54e-05*		2.14e-05*		-9.08e-06		1.47e-05
	(0.962)		(0.0671)		(0.0506)		(0.345)		(0.121)
educ_gdp		0.941***	0.972***						
		(0)	(0)						
educ_gov				0.0256	0.0210				
				(0.712)	(0.762)				
health_gdp						0.431***	0.491***		
						(7.78e-05)	(0.000111)		
health_gov								-0.0188	-0.0524
								(0.658)	(0.281)
Constant	24.82***	20.97***	21.09***	24.57***	24.19***	21.72***	21.57***	24.11***	24.23***
	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Obs	1,044	762	756	501	501	776	768	776	768
R^2	0.000	0.070	0.076	0.000	0.009	0.022	0.024	0.000	0.004
Number of c_n	87	75	75	71	71	84	84	84	84

Notes: P-values are in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Conclusions and future work

Income distribution is central to tax design; and in developing countries the low level of direct taxation on income and assets is a major concern in the context of growing income inequality on the one hand and the need for greater domestic resource mobilisation on the other. Social protection in most developed countries takes the form of fiscal transfers funded from a progressive income tax for three reasons: first, indirect taxation tends to be regressive and thus direct taxation is required even to make the overall tax rate 'flat'; second, indirect taxation at feasible levels does not provide sufficient revenue; and third, progressive income tax is regarded as 'fair' or 'just' in democratic societies.

The long-term goal of greater equality inevitably passes through fiscal redistribution. As Table 5 indicates, *market* (i.e. before taxes and transfers) income inequality in Europe is similar to that of Latin America – the most unequal region in the world. To become the most equal region post-fiscal, in Europe one third of the improvement is from tax incidence and two thirds from expenditure incidence. In marked contrast, the overall fiscal impact on distribution in Latin America is very small; although even here, half the modest effect is from taxation. To put this another way, if the redistributive effect of direct taxation were similar in Latin America to Europe, then the fiscal reduction in inequality would be three times greater than at present.

Table 5: Gini Coefficients for Household Income before ('market') and after ('disposable income') fiscal redistribution in Europe (15 countries) and Latin America (6 countries)

	Disposable income	Market Income	Difference	Of which tax
Europe	0.31	0.46	- 0.16	- 0.03
Latin America	0.50	0.52	- 0.02	- 0.01

Source: Goñi at al (2011) (based on their Table 1).

The conventional view on income taxation in developing countries has held that, especially in lower-income countries, tax levels and structures can and should be separated from expenditure levels and structures: tax policy is concerned with efficiency (revenue levels, collection costs and incentives) while expenditure policy is concerned with redistribution

(social protection, public goods and human capital formation). When combined with claims about the administrative difficulty of collecting income taxes in poor countries, the conventional view appears to justify the reduced role of and priority given, to this source of development revenue.[8] In consequence while developing countries have managed to raise tax pressure in recent decades (in order to both extend social protection and to reduce fiscal deficits and debt), this has mainly been achieved raising indirect taxes on consumption (which are broadly regressive) and indeed these now approach the level of those in developed countries and are probably approaching their logical limit (IMF, 2011).

This paper is essentially exploratory, and its main aim has been to establish a case for further research on the topic, using the Plato Index or a similar metric that can be estimated for a large number of developing countries over a sufficiently long time period to detect structural changes – given that both fiscal reform and income distribution take a long time, and that the relevant indicators frequently suffer from short-term fluctuations due to external shocks (such as commodity cycles) or internal socks (such as inflation). At the same, the good country coverage for developed countries, and the ensuing overlap of Plato Index results with more detailed indicators of redistributional impact of taxes available more likely for developed countries, provides an opportunity for a more detailed comparisons of these various indicators in future research.

The main finding that seems to emerge from the data is that there is a positive correlation between progressive taxation and social provision, independently of the level of economic development (i.e. GDP per capita). It is of course commonly observed that both tax progressivity and social protection tend to improve with the level of per capita income – because there are more resources available, because fiscal administration improves (both in taxation and spending) and because democracy works better.

What do seem to be emerging however are two 'conjectures' which require further exploration in terms of specific hypotheses:

[8] 'During recent decades, a powerful consensus has developed… [which] has included not only the structure of taxes, but also the level of tax rates. This conventional wisdom is probably pretty soundly based, and so to refuse to subscribe to it would be imprudent as well as incurring disapproval from IFIs [i.e. international financial institutions].' Adam & Bevan (2004; p.60). Heady (2004) provides a series of criticisms of the theory and application of the consensus

i. *A positive correlation between income tax and social protection would imply that both should be implemented simultaneously.* But how this might work depends on the direction of causation involved, so that further research is needed on:
   a. If higher income tax provides extra resources for social protection once a feasible maximum of direct taxation has been reached (the 'fiscal funding' hypothesis);
   b. If the previous level of social protection makes higher income tax possible by legitimising redistributive fiscal transfers (the 'social legitimation' hypothesis);
   c. If greater access of poorer groups to fiscal decision making simultaneously affects *both* income taxation *and* social protection (the 'economic democratisation' hypothesis).

ii. *The wide disparity between geographical regions and within these regions, implies that there is considerable policy space for raising direct taxation.* However, to do this the constraints imposed by structural factors need to be better identified and tested against the data:
   a. The influence of other sources of non-tax fiscal funding, such as natural resource royalties on the one hand, or development assistance on the other (the 'Dutch disease' hypothesis);
   b. The organisational structure of the economy in terms of large and small firms, informal activities etc.; and thus the capacity (as opposed to the willingness) to tax higher incomes and profits the 'informal economy' hypothesis;
   c. The administrative strength of the public administration in general and the fiscal authorities in particular (the 'fiscal capacity' hypothesis).

Clearly the explanation will vary as between countries, and all drivers may be present in any one of them; which why although cross section and times series work of this kind can never substitute for detailed country case studies, it can provide a comparative context for such studies (including appropriate benchmarks) and, we hope, generate useful working hypotheses.

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