FONDATION POUR LES ÉTUDES ET RECHERCHES SUR LE DÉVELOPPEMENT INTERNATIONAL

Working Paper 186 February 2017 Development Indicators

Reassessing Tax Effort in Developing Countries: a Proposal of a Vulnerability-Adjusted Tax Effort Index (VATEI)

Hermann Djedje Yohou
Michaël Goujon

Hermann Djedje Yohou, PhD in Economics from CERDI, and consultant FERDI (corresponding author) **E-mail : dher.yohou@gmail.com**

Michaël Goujon is Associate Professor in economics at CERDI-CNRS-University Clermont Auvergne. He is also program officer for "Innovative Development Indicators" at Ferdi.

Abstract

This paper describes the estimation of a new tax effort index for 120 developing countries over 1990-2012. Two major innovations are the use of a new measure of non-resource tax revenues and the correction of the traditional method of tax effort estimation by accounting for structural economic and human vulnerabilities. The results indicate that economic vulnerability is harmful to tax while human asset enhances tax. Moreover, Sub-Saharan African countries exhibit an outstanding vulnerability-adjusted tax effort compared to the other countries.

Keywords: Tax effort, Economic vulnerability, human assets, Non-resource tax revenue, non-resource GDP, Developing countries

LA FERDI EST UNE FONDATION RECONNUE D'UTILITÉ PUBLIQUE.
ELLE MET EN ŒUVRE AVEC L'IDDRI L'INITIATIVE POUR LE DÉVELOPPEMENT ET LA GOUVERNANCE MONDIALE (IDGM).
ELLE COORDONNE LE LABEX IDGM+ QUI L'ASSOCIE AU CERDI ET À L'IDDRI.
CETTE PUBLICATION A BÉNÉFICIÉ D'UNE AIDE DE L'ÉTAT FRANÇAIS GÉRÉE PAR L'ANR AU TITRE DU PROGRAMME «INVESTISSEMENTS D'AVENIR» PORTANT LA RÉFÉRENCE «ANR-10-LABX-14-01».

1 Introduction

A large body of literature demonstrates that building taxation is a key engine for inducing a sustained and vigorous welfare and accelerating development in the least developed countries (Moore et al., 2007; Besley and Persson, 2010, 2013). Since the conference of Monterrey in 2002, the issue of domestic mobilization in developing countries has gained a lot of attention from donors. This has induced a revival study of tax issues in developing countries.

A substantial amount of empirical works have looked for the determinants of government revenues in developing countries. Bird et al. (2008) have analyzed the impact of corruption, voice and accountability on tax revenues in developing countries and high income countries. Knack (2009) explores the relationship between foreign aid, natural resource exports on tax systems quality for developing countries. Mahdavi (2008) analyzes the effects of a set of factors including demographic, gender and political variables on tax revenues. Agbeyegbe et al. (2006) analyze the impact of the trade liberalization and exchange rate changes on tax revenue in Sub-Saharan Africa. A growing amount of papers examine the effect of foreign aid, either its direct or conditional effect, on tax revenues (Prichard et al., 2013; Brun et al., 2011b,a; Crivelli and Gupta, 2016; Yohou et al., 2016; Clist and Morrissey, 2011).

In order to highlight the achievements of countries due to the quality of their policies, the literature dissociates the concept of tax capacity or potential tax level from that of tax effort. The potential tax level refers to the level of the tax collection allowed by the structural factors of an economy that are independent of authorities' willingness at least in the short run (Brun et al., 2011a; Goujon and Wagner, 2016). These structural factors include in general the trade openness, the level of development and the sectoral composition of the economy variables. The tax effort measures the extent to which the actual level of tax revenues deviates from the potential tax as predicted by these structural factors. Tax efforts is then considered as the result of political will and policies. Actual debates in tax effort studies concern the measures and data on tax revenues, and the factors of potential tax. Here we propose a new measure of tax revenue and to take into account country vulnerabilities as new factors of potential tax.

Few studies on tax effort account for the structural vulnerability although there are strong evidences that it matters in understanding the persistent inefficiencies of a number of developing countries. Von Haldenwang and Ivanyna (2015), Von Haldenwang et al. (2013) and Morrissey et al. (2016) find that tax revenues in developing countries are vulnerable to external shocks and that the effects are deeper for the poorest countries.

Many of the developing countries face structural handicaps including low human asset, economic and climate vulnerabilities, that compromise development directly and by worsening funding resources. Revenue mobilization can be affected by vulnerabilities indirectly through lower GDP and growth, lag in economic transformation and modernization, lower openness and so on, which

are the usual determinants of tax potential. But vulnerabilities can also impact revenue mobilization directly. These economic vulnerabilities are related to highly dependence on a few commodities-export prices like agriculture, oil and mining products. Commodity export prices are very volatile and induces uncertainty in the economy (instability of revenue earnings of producers and government revenues etc.). This uncertainty may compromise a good medium-term plan of public spending and then their quality, reduce the level of spending (investment) and lower growth. As a result, a further sustained revenue collection is unlikely. Furthermore, climate shocks may cause the displacement of populations, destroy their activities and public infrastructures including those of tax administrations. This may complicate the tax collection and lower the efficiency of tax administrations. In front of such problems, government may also be led to cut tax rates or to provide exemptions in order to help producers in mitigating the adverse effects of vulnerabilities.

The relationship between education and heath and taxation is related to the willingness to pay tax in one hand and in the other hand to the state abilities in having an adequate staff for enforcing and collecting tax revenues. Indeed, according to Alm et al. (1992) people's willingness to pay tax depends on the value of goods and services they receive from government. For Fenochietto and Pessino (2013), more educated people can understand why and how to pay taxes. Higher education and health can also cause higher productivity and higher (and more sophisticated) economic activity that should increase the tax base.

Here we propose an estimation of tax effort that takes into account the different dimensions of structural vulnerability for a large panel of developing countries over the last three decades. We use two composite indicators, the Economic Vulnerability Index and the Human Assets index, built and used by the United Nations to identify Least developed countries, for which historical time series are provided by the Ferdi.

The results support our idea that these two dimensions should be taken into account in assessing tax effort for developing countries. Indeed, we find that economic vulnerability is harmful to tax revenue while human asset enhances tax revenues.

The paper is organized as follows. Section 2 describes the data and the methodology. Section 3 presents the results of estimation. Section 4 discuss the resulting tax effort index. Section 5 concludes.

2 Model and data

The method starts with an econometric regression of the actual tax revenue in country i and year t (Tax_{it}) on the structural determinants of tax (X_{it}):

$$Tax_{it} = \beta X_{it} + TE_{it} \tag{1}$$

We then consider that the residual of the regression (TE_{it}), that can be derived from the estimation, represents the tax effort:

$$TE_{it} = Tax_{it} - \hat{\beta} X_{it} \tag{2}$$

For a given country, tax effort is then considered as relatively low (high) if observed tax is lower (higher) than the predicted tax $\hat{\beta} X_{it}$, resulting in a negative (positive) value of TE_{it}. TE_{it} is a relative indicator, allowing the comparison between countries (and over time). According to this method, the "revealed" tax effort measures the authorities' willingness and capacity to collect tax beyond structural factors (authorities' willingness being partly induced by structural factors).

The tax effort measure being a residual, different assumptions underlie the validity of the indicator (Boussichas et al., 2010). First, no important explanatory variables must be omitted from the regression such that the residual accurately reflects the effect of tax policy or effort. Second, the included explanatory variables must be exogenous with regard to tax mobilization, at least in the short run. Third, the functional form of the regression must be specified correctly. Fourth, there must be no measurement error. Given the restrictiveness of these assumptions, our results must be considered with caution. The panel data regression takes the following general form:

$$Tax_{it} = c + \beta X_{it} + \alpha_i + \theta_t + u_{it} \tag{3}$$

with α_i being the specific country effects (unobservable countries' characteristics that are time invariant), and θ_t the specific time effects (unobservable time characteristics that are common for countries). The regression is run following the random effects model (against the "fixed effects" model), when all important structural determinants have been included in X_{it}. Thus α_i and θ_t are components of the tax effort with u_{it}.

In line with our goal, some notable changes are brought in the traditional reduced form of tax equation. Recent specifications from Fenochietto and Pessino (2013), Crivelli and Gupta (2016) and Brun et al. (2015) use the share of non-resource taxes in total GDP as dependent variable and include resource taxes among the explanatory variables. However, total GDP includes the resource sector production. Due to booms and busts in natural resource exploitation, and higher volatility in international prices, and consequently on resource production value added, (non resource) tax to total GDP ratio becomes artificially unstable. Using the ratio of non-resource tax to total GDP may also generate a resource-penalizing-bias suggesting that non-resource taxes should automatically decrease as total GDP increases when resource production rises. Resource-rich countries would then demonstrate artificially a low non-resource tax effort. To avoid such a

bias, we use non-resource tax revenues as a share of *non-resource GDP* for country i at time t as the dependent variable. [1]

Data on tax revenue are from the 2016 government revenue dataset of the International Center for Taxation and Development (ICTD) (Prichard et al., 2014; Prichard, 2016). In very rare cases and when consistency allows, we complete with data from Mansour (2014) and International Monetary Fund (IMF). The panel data is unbalanced since we were unable to fill consistently all the gaps. The final dataset covers 120 countries over the period 1990-2012. ICTD disentangles the revenues into non-resource tax revenues, resource tax revenue, and non tax revenues for a large number of countries. Data from Mansour (2014) adopts a similar approach but it only covers sub-Saharan African countries.

$ResourceTax$ includes both resource tax and other non-tax revenues. For most of the countries included in our sample, resource tax are higher than non-tax. Also, the variability in resource tax is higher than in other non-tax revenues. Moreover, it is well-known that the distinction between resource tax and non-tax is actually difficult to find. From the hypothesis of natural resource curse, we expect that the capacity of a country to raise non resource taxes decreases with a higher dependence on natural resources. $ResourceTax$ is also from ICTD completed by Mansour (2014) and IMF data.

A major contribution of this paper is to correct the usual derived tax effort index with the effect of human capital and economic vulnerabilities following Goujon and Wagner (2016). We use two composite indicators, the Economic Vulnerability Index (EVI) and the Human Assets Index (HAI), built and used by the United Nations to identify the Least developed countries, for which historical time series are provided by the Ferdi (Closset et al., 2014; Feindouno and Goujon, 2016). The EVI is a synthetic index of the structural vulnerability, independent from the current policy or resilience, composed of the magnitude of shocks and the exposure to shocks. The EVI is the simple arithmetic average of 2 sub-indices, one for the exposure and one for the shocks. The exposure sub-index is a weighted average of 5 component indices: population size (25%), remoteness from world markets (25%), exports concentration (12.5%), share of agriculture, forestry and fishery in GDP (12.5%) and the share of population living in low elevated coastal zone (25%). The shocks sub-index is a weighted average of 3 component indices: the victims of natural disasters (25%), the instability in the agricultural production (25%), and the instability in exports of goods and services (50%). The HAI is a composite indicator which is a simple average of four indicators, two indicators of health and nutrition outcomes (Percentage of the population undernourished, Mortality rate for children aged five years or under) and two indicators of education (Gross secondary school enrollment ratio, Adult literacy rate). Components of EVI and HAI are built on different kinds of primary data (number, percent, index), which are normalized through a min-max procedure, to get component indices ranging from 0 to 100, with high scores corresponding to a high level of vulnerability or a high level of human

[1] Non-resource taxes also exclude social contributions as usual.

assets respectively. Thus let us rewrite equation 3 as:

$$\frac{NonresourceTax_{it}}{NonresourceGDP_{it}} = \alpha_i + \beta X_{it} + \gamma ResourceTax + \phi HAI_{it} + \mu EVI_{it} + \epsilon_{it} \quad (4)$$

X comprises the set of the usual structural tax determinants: the level of development, the trade openness, and the composition of the economy.

The level of development is proxied by the log of GDP per capita in purchasing power parity (PPP) constant 2005. The level of development is assumed to increase and sophisticate the demand for public services and then to enhance people capacity and willingness to pay taxes. The expected sign is then positive. Following Fenochietto and Pessino (2013), we add the square of this variable to account for the non-linearity between taxes and development. Data on GDP are from the World Development Indicator (WDI) of the World Bank.

The trade openness variable is measured by the sum of the ratios of export and import to GDP. We use here the ratio of Import to GDP instead of the trade openness as many studies have shown that import remains the main source of border taxes since trade liberalization in the 1980s and 1990s. In addition, this helps also avoiding a double accounting with resource revenues that represent a significant part of developing countries exports. Data of trade openness are from WDI.

The structure of the economy is usually measured by the shares of agriculture and industry in GDP. But taxes on industry in developing countries is mainly levied on mining sector and export. To avoid double accounting with resource revenues, we use the share of the manufacturing sector in GDP that excludes mining. Agriculture is measured by the share of this sector in GDP.[2] Manufacture sector is easier to tax unlike the agricultural sector. Thus a negative and a positive effects are expected for agriculture and manufacture, respectively. Data are from the Division of Statistics of the United Nations (UNDATA).

2.1 Data description

Table 1 shows the descriptive statistics of the government revenue indicators for our sample of annual data for 120 countries over 1990-2012.

On average, the level of the government revenues represents 21.5% of GDP with average levels of non-resource tax and resource-tax at 13.5% and 7.9% of GDP respectively.

The high values of the standard deviations show that there are huge disparities across countries. The minimum value of the government revenues is recorded by Democratic Republic of Congo

[2]To be noted that the EVI includes the share of agriculture as a component.

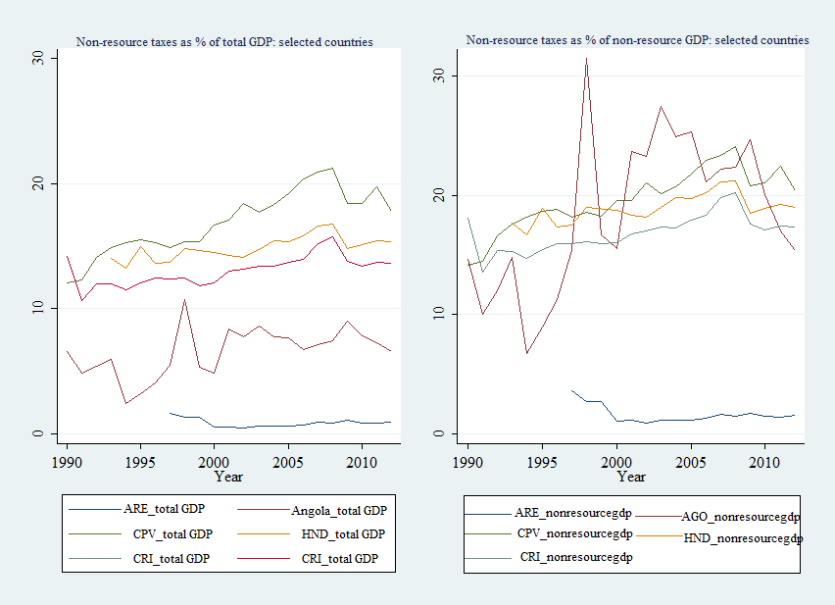
Table 1: Summary statistics 120 countries, 1990-2012

Variable	Mean	Std. Dev.	Min.	Max.	N
Government revenue (% GDP)	21.468	10.83	0.679	89.827	2656
Non-Resource taxes (%GDP)	13.533	7.093	0.086	62.829	2625
Non-resource taxes (% Non-resource GDP)	18.459	9.952	0.163	87.384	2608
Resource Tax(%GDP)	7.931	11.156	0.000	88.288	2602
Real per capita Income (log)	8.496	1.155	5.508	11.806	2641
Manufacture (% of GDP)	12.498	7.396	0.000	45.666	2760
Agriculture (% of GDP)	18.497	14.539	0.091	80.511	2760
Import (% of GDP)	42.911	23.157	3.467	207.86	2760
HAI	64.612	25.218	2.458	100.000	2742
EVI	36.111	13.222	11.206	85.367	2687

Source: ICTD, Mansour (2014), IMF, World Bank, FERDI

at 0.7% of GDP in 1994. Kuwait shows the highest level of resource tax revenues at 88.3% of GDP in 1990 and the lowest level of non-resource tax revenues at 0.1% of GDP in 1992.

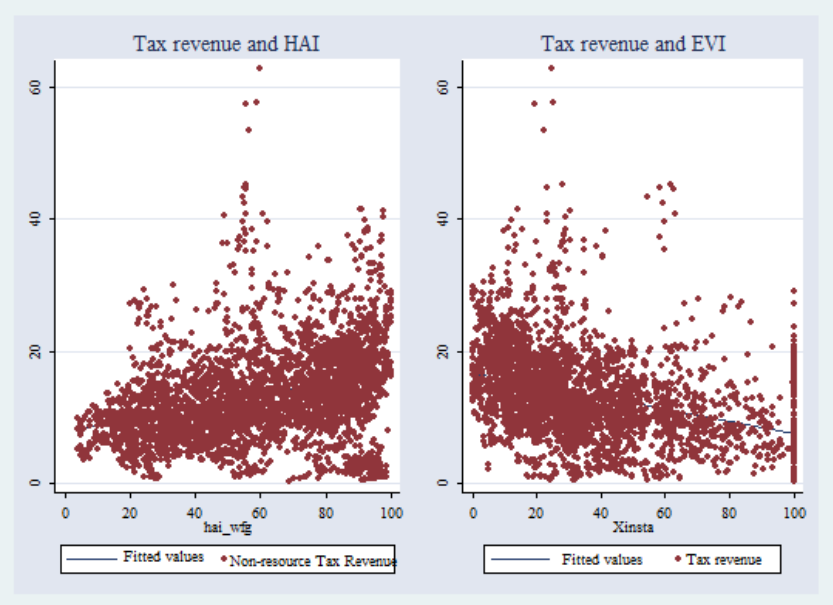
Figure 1: Non-resource taxes as of % total GDP versus Non-resource taxes as of % non-resource GDP



Source: Authors from ICTD and Mansour (2014). Notes: AGO: Angola, UAE: United Arab Emirates, CPV: Cabo Verde, CRI: Costa Rica, HND: Honduras.

Figure 1 shows how the choice of the denominator in the non-resource tax ratio, between total GDP and non-resource GDP, is important. Particularly, resource-rich countries (not all) show a very higher performance when non-resource GDP is used instead of total GDP. Figure 2 depicts the relationship between the non-resource tax (as a percent of non resource GDP) and HAI and EVI for the whole sample. It emerges a positive relationship between non-resource tax and HAI

Figure 2: Non-resource tax (as a percent of non-resource GDP), HAI and EVI



Source: Authors Authors from ICTD, Mansour (2014) and FERDI.

but a negative relationship with EVI.

3 Results of estimation

Table 2 reports the results of estimations of Equation 4. To avoid endogeneity bias, all the independent variables enter into the regressions with a one-period lag. Results are obtained by Generalized Least Squared estimation. In order to highlight the relevance of including EVI and HAI, two groups of estimations are reported: the basic models as those found in the literature and the vulnerability adjusted models. Across both groups, results of different specifications are reported. They aim to test how the results are sensitive to the inclusion of a non-linear impact of income level and to address some specific concerns about collinearity between agriculture and per capita income. Another reason is that EVI includes a variable of agriculture as a percent of GDP.

With the exception of the level of income, the magnitude of the parameters does not vary much across the different regressions. Since all the parameters almost keep their signs and their statistical significance, we focus on model 4 and model 8 for the usual and the vulnerability-adjusted models, respectively.

The results indicate that the variables are all statistically significant with the expected signs

irrespective of the specifications. Overall, the coefficient of the income per capita rises when its square enters the regression but decreases when agriculture is included. Regarding our variables of interest, HAI enters the regressions positively while EVI enters negatively as expected. A one point increase in HAI raises non-resource tax ratio by 0.6%. On the contrary, a 1 point increase in EVI cuts tax ratio by 0.4%. Pairwise comparisons between the corresponding specifications indicate that HAI and EVI affect tax collection also through the income and the agriculture sector as the estimated parameters on these variables are lower in vulnerability-adjusted models.

Model 4 and 8 indicate that higher income level is conducive to higher tax collection but the magnitude of this effect diminishes when the per capita income exceeds a certain threshold. The decreasing returns of income is also found in Fenochietto and Pessino (2013). The measured impact of income and the turning point are lower in model 8 than in model 4 ($6670 and $12460 respectively). This result suggests that the contribution of the level of income in tax capacity is conditioned on HAI and EVI.

As expected, non-resource tax revenues decreases with resource tax revenues, suggesting a lower capacity or willingness to tax in resource-rich countries. An increase in resource tax by one unit is associated with a 0.9% decrease in non resource tax. The coefficient of Import to GDP ratio is positive and statistically significant in all regressions.

Table 2: Non-resource taxes as % of non-resource GDP (log), Random effects Model

	Usual Models				Vulnerability-adjusted Models			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
log of Per capita Income	0.228***	1.590***	0.128***	1.358***	0.063**	1.003***	0.019	0.951***
	(0.02)	(0.20)	(0.02)	(0.20)	(0.03)	(0.21)	(0.03)	(0.21)
Resource Tax revenues	-0.010***	-0.009***	-0.010***	-0.009***	-0.009***	-0.008***	-0.010***	-0.009***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Import	0.004***	0.004***	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Manufacture	0.010***	0.009***	0.008***	0.008***	0.011***	0.010***	0.009***	0.009***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
log of Per capita Income square		-0.080***		-0.072***		-0.054***		-0.054***
		(0.01)		(0.01)		(0.01)		(0.01)
Agriculture			-0.011***	-0.011***			-0.008***	-0.008***
			(0.00)	(0.00)			(0.00)	(0.00)
Human Asset Index					0.008***	0.007***	0.007***	0.006***
					(0.00)	(0.00)	(0.00)	(0.00)
Economic Vulnerability Index					-0.006***	-0.005***	-0.004***	-0.004***
					(0.00)	(0.00)	(0.00)	(0.00)
Constant	0.596***	-5.071***	1.705***	-3.458***	1.714***	-2.215**	2.296***	-1.617*
	(0.18)	(0.84)	(0.21)	(0.85)	(0.21)	(0.90)	(0.23)	(0.90)
Observations	2381	2381	2381	2381	2317	2317	2317	2317
R^2	0.094	0.2300	0.149	0.262	0.145	0.226	0.254	0.254

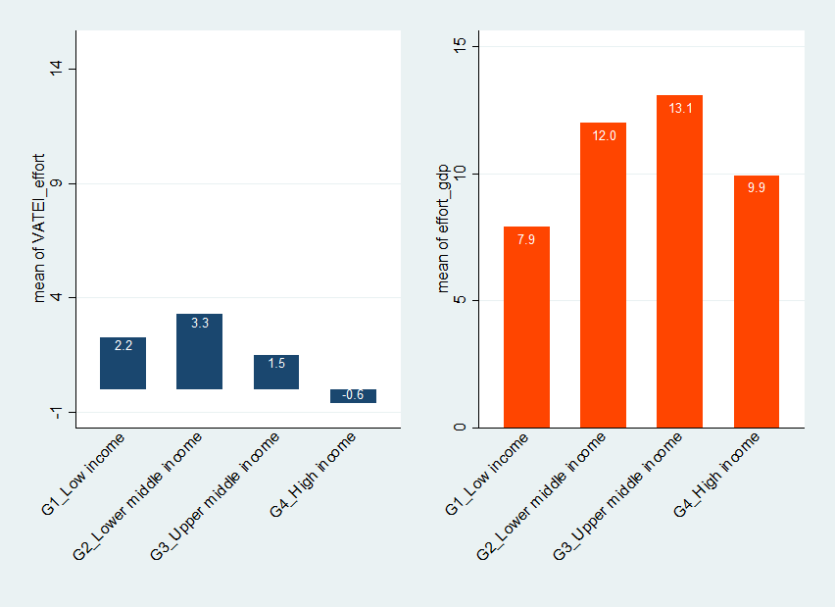
Hence our results are largely consistent with those of the empirical and theoretical expectations. In addition, they show that the relative structural handicaps in human capital and economic vulnerability matter for tax collection. The next section discusses the results for the tax effort index resulting from the estimations above.

4 Tax Effort Index

This section presents the vulnerability-adjusted tax effort by groups of countries. We begin by showing how adjusting tax effort index for vulnerabilities affects country ranking. Before, we merely plot Tax effort index using non-resource tax to GDP versus non-resource tax to non-resource GDP (Figures 3 and 4). Table 3 reports the tax effort indices that adjusts and that does not adjust for the structural handicaps. Both comparisons are led according to geographic regions and income groups.

Figures 3 and 4 confirm the earlier observations that the tax to total GDP Effort Index tends to overestimate the effort in tax collection by lowering the estimated tax potential. By contrast, Table 3 shows that the adjusted tax effort tends to straighten performances across countries although both indicators are very correlated. Hence, the measures exhibited by the adjusted tax effort index are more economically reasonable.

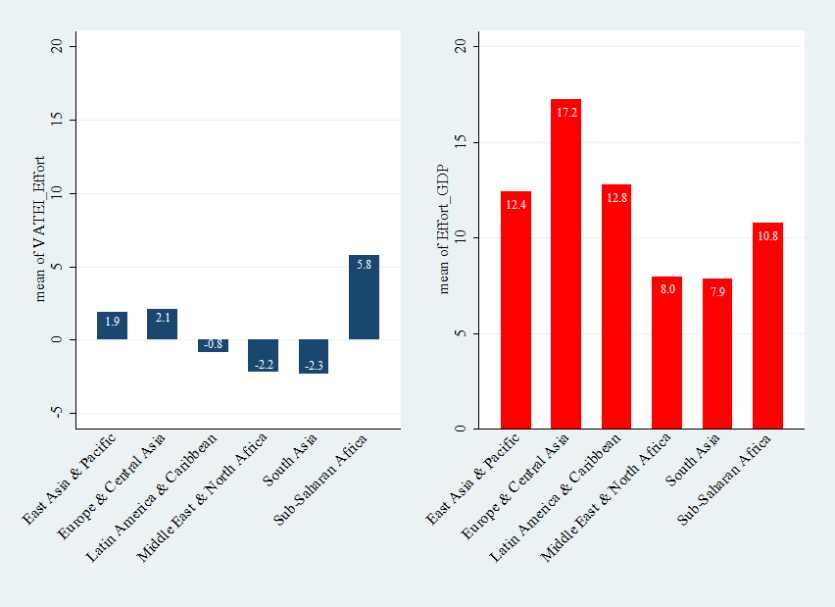
Figure 3: Tax effort index using non-resource tax to non-resource GDP versus non-resource tax to GDP, by income groups



Source:Authors' calculations

The analysis of the tax effort index shows that on average, the entire sample has overrun their tax potential. On average the tax effort index has amounted to 1.9 percentage points of non-resource GDP greater than the tax potential. Nevertheless, the regional analysis demonstrates that this performance is mainly led by the Sub-Saharan African countries that exhibit an outstanding tax effort index of 5.8 percentage points of non-resource GDP. After a continual increase, their tax

Figure 4: Tax effort index using non-resource tax to non-resource GDP versus non-resource tax to GDP, by region



Source:Authors' calculations, ICTD, Mansour (2014) and IMF

effort has moderately declined since the mid of 2000s. Similar outperformances emerge from Brun et al. (2015). There would be the results of the sustained economic and fiscal reforms engaged since the launch of the former structural adjustment Programs and improved in the frame of the Heavily Indebted Poor Countries initiatives with the technical support of international partners notably IMF, World Bank and African Development Bank. The East Asian and Pacific has also outweighed tax potential. European developing countries record a persistent increase in tax effort since the 1990s before a significant decline, over the period of 2010-2012. Latin America and the Caribbeans and the MENA show the weakest relative performance since their tax effort is almost always negative.

Similar conclusion may be drawn from the income group analysis. Low income, lower middle income and upper middle income countries exhibit a positive tax effort index, respectively 2.2, 3.3 and 1.5 of percentage of non-resource GDP higher than their respective tax potential. Adversely, the high income countries which are essentially rich-natural resource countries, have a negative tax effort index up to 0.6 percentage points of non-resource GDP lesser than their tax potential. However, apart the upper middle income countries, performances have improved across the groups. We note a general decline in tax effort over the period 2010-2012 and more earlier over 2005-2009 for LIC. This decline may be attributed to the recent world economic recession that has led to some tax cuts in order to mitigate its social consequences.

Table 3: Vulnerability-adjusted versus non-adjusted tax effort index

	1990-1995			1996-1999			2000-2004			2005-2009			2010-2012			Total		
	VATEI	Nonadjust	Diff	VATEI	Nonadjust	Diff	VATEI	Nonadjust	Diff	VATEI	Nonadjust	Diff	VATEI	Nonadjust	Diff	VATEI	Nonadjust	Diff
EA	3.3	4.1	-0.8	2.6	2.8	-0.8	0.8	1.5	-0.9	1.4	2.5	-1.1	1.9	3.3	-1.4	1.9	2.7	-1.0
Std. Dev.	5.7	5.5	1.2	5.7	5.6	1.2	5.8	5.9	1.3	6.0	6.1	1.3	6.4	6.6	1.4	5.9	5.9	1.3
N	60	63	60	81	81	81	83	88	83	89	90	89	51	51	51	364	380	364
Europe &	-1.3	-0.7	-0.6	0.3	1.7	-1.4	3.2	4.4	-1.9	4.4	5.1	-2.0	3.7	4.8	-2.1	2.1	3.3	-1.6
Std. Dev.	1.3	1.5	0.4	3.1	2.5	0.2	1.4	1.7	0.4	2.8	2.8	0.6	1.0	2.2	0.6	3.0	3.0	0.7
N	8	8	8	10	14	10	10	15	10	10	15	10	7	9	7	45	61	45
LAC	-2.4	-2.4	0.1	-1.7	-1.6	-0.2	-1.0	-0.5	-0.5	0.5	1.3	-0.8	0.5	1.5	-1.0	-0.8	-0.3	-0.5
Std. Dev.	5.3	5.6	1.1	5.4	5.7	1.2	6.4	6.7	1.4	7.5	7.6	1.2	6.7	6.8	1.0	6.4	6.7	1.2
N	90	90	90	127	127	127	134	134	134	131	131	131	80	80	80	562	562	562
MENA	-0.3	-0.9	0.8	-0.4	-1.1	0.5	-2.4	-2.3	0.0	-2.9	-2.7	-0.2	-4.4	-3.7	-0.7	-2.2	-2.2	0.0
Std. Dev.	9.3	9.4	1.9	8.3	8.0	1.8	8.0	8.0	1.4	7.2	7.4	1.4	7.4	7.4	1.3	8.0	7.9	1.6
N	36	38	36	59	61	59	79	79	79	81	81	81	46	46	46	301	305	301
SA	-0.3	-0.3	-0.1	-1.0	-0.8	-0.2	-2.8	-2.4	-0.4	-3.5	-3.2	-0.3	-3.2	-2.5	-0.6	-2.3	-2.0	-0.3
Std. Dev.	3.7	4.7	1.2	2.9	3.6	1.2	3.3	3.6	1.2	3.5	3.9	1.3	4.0	3.9	1.3	3.6	4.0	1.2
N	24	24	24	30	30	30	34	34	34	40	40	40	23	23	23	151	151	151
SSA	4.7	5.4	0.7	6.0	6.0	0.6	6.2	5.5	0.6	5.8	5.4	0.4	5.7	5.6	0.1	5.8	5.6	0.5
Std. Dev.	9.3	9.9	0.9	11.7	11.7	1.1	9.5	8.9	1.2	10.6	10.3	1.2	8.3	8.1	1.4	10.1	10.0	1.2
N	144	160	144	195	207	195	214	214	214	213	213	213	128	128	128	894	922	894
Total	1.8	2.2	0.2	2.2	2.3	0.1	1.8	1.9	-0.1	1.9	2.2	-0.3	1.8	2.4	-0.6	1.9	2.2	-0.1
Std. Dev.	8.1	8.6	1.3	9.2	9.3	1.3	8.5	8.1	1.4	9.0	8.8	1.4	8.1	7.9	1.4	8.7	8.6	1.4
N	362	383	362	502	527	502	554	564	554	564	570	564	335	337	335	2317	2381	2317
Income group																		
HIC	0.4	0.8	-0.4	-0.6	-0.6	-0.2	-0.3	-0.2	-0.1	-1.1	-0.8	-0.3	-1.4	-1.0	-0.4	-0.6	-0.4	-0.3
Std. Dev.	8.0	8.3	1.4	7.3	7.4	1.7	12.0	11.4	1.8	7.6	7.7	1.5	8.3	8.2	1.4	9.0	8.9	1.6
N	46	46	46	69	71	69	84	84	84	81	81	81	49	49	49	329	331	329
LIC	1.9	1.4	0.4	2.2	2.0	0.2	2.3	2.1	0.2	1.6	1.7	-0.1	3.7	4.2	-0.5	2.2	2.2	0.0
Std. Dev.	6.0	6.1	0.7	6.3	6.2	0.7	5.9	5.7	0.8	4.0	4.1	0.8	6.0	6.0	0.9	5.7	5.7	0.8
N	85	85	85	118	118	118	126	126	126	128	128	128	78	78	78	535	535	535
LMIC	2.4	3.2	0.4	3.8	4.0	0.4	3.1	2.9	0.1	3.9	4.1	-0.2	2.5	3.0	-0.6	3.3	3.5	0.0
Std. Dev.	6.0	7.8	1.4	7.6	8.3	1.4	8.2	7.5	1.4	12.0	11.3	1.5	9.5	9.1	1.5	9.0	9.0	1.5
N	119	131	119	156	170	156	166	176	166	174	180	174	105	107	105	720	764	720
UPMIC	1.6	2.2	0.1	1.8	2.1	-0.2	1.3	1.7	-0.4	1.6	2.1	-0.5	1.3	2.1	-0.8	1.5	2.0	-0.4
Std. Dev.	10.9	10.7	1.3	12.4	12.0	1.4	8.2	8.0	1.5	8.4	8.3	1.6	7.3	7.2	1.5	9.6	9.4	1.5
N	112	121	112	159	168	159	178	178	178	181	181	181	103	103	103	733	751	733
Total	1.8	2.2	0.2	2.2	2.3	0.1	1.8	1.9	-0.1	1.9	2.2	-0.3	1.8	2.4	-0.6	1.9	2.2	-0.1
Std. Dev.	8.1	8.6	1.3	9.2	9.3	1.3	8.5	8.1	1.4	9.0	8.8	1.4	8.1	7.9	1.4	8.7	8.6	1.4
N	362	383	362	502	527	502	554	564	554	564	570	564	335	337	335	2317	2381	2317

Source:Authors'calculations. Note: VATEI is the vulnerability adjusted tax effort index. Nonadjust is the non-adjusted vulnerability tax effort index. Diff is the difference between the two indices.

5 Conclusion

This paper proposes an improved estimation of the tax effort index in developing countries. Its main contribution is to account for the effects of structural human and economic handicaps that characterize the developing countries. It uses recent tax revenue data from ICTD, IMF and retrospective series of economic vulnerability and human assets measures from Ferdi. The tax effort index also provides a meaningful sight on how the use of tax to non-resource GDP ratio should be preferred to the usual measure of tax to total GDP ratio.

The results indicate that economic vulnerability is harmful to taxes while human asset enhances taxes. The estimated tax effort index shows that SSA are the top performers. Low income and vulnerable countries do relatively better in collecting taxes than the other groups. Consequently, an additional tax effort would certainly create distorsions in the economy if f they are not preceded by policies aiming at lowering vulnerabilities and enhancing human capital. Financial support to the vulnerable countries is yet important to cover financial needs facing an already high tax effort.

Bibliography

Agbeyegbe, T. D., J. Stotsky, and A. WoldeMariam (2006): "Trade liberalization, exchange rate changes, and tax revenue in Sub-Saharan Africa," *Journal of Asian Economics*, 17, 261–284.

Alm, J., G. H. McClelland, and W. D. Schulze (1992): "Why do people pay taxes?" *Journal of Public Economics*, 48, 21–38.

Besley, T. and T. Persson (2010): "State capacity, conflict, and development," *Econometrica*, 78, 1–34.

——— (2013): "Taxation and Development, Handbook of Public Economics Vol. 5," .

Bird, R. M., J. Martinez-Vazquez, and B. Torgler (2008): "Tax effort in developing countries and high income countries: The impact of corruption, voice and accountability," *Economic Analysis and Policy*, 38, 55–71.

Boussichas, M., M. Goujon, et al. (2010): "A quantitative indicator of the immigration policys restrictiveness," *Economics Bulletin*, 30, 1727–1736.

Brun, c., G. Chambas, and M. Mansour (2015): "Effort fiscal dans les PED, une mesure alternative," *Boussichas et Guillaumont, Financer le dveloppement durable, Economica.*

Brun, J.-F., G. Chambas, and S. Guerineau (2011a): "Aide et mobilisation fiscale dans les pays en développement," *Jumbo*, Octobre 2007-21, 1–53.

Brun, J.-F., G. Chambas, and B. Laporte (2011b): "IMF programs and tax effort What role for institutions in Africa?" *CERDI Etudes et Documents*, 2010.33.

Clist, P. and O. Morrissey (2011): "Aid and tax revenue: signs of a positive effect since the 1980s," *Journal of International Development*, 23, 165–180.

Closset, M., S. Feindouno, and M. Goujon (2014): "Human Assets Index Retrospective series: 2013 update," *FERDI Working Paper*, 110.

Crivelli, E. and S. Gupta (2016): "Does conditionality in IMF-supported programs promote revenue reform?" *International Tax and Public Finance*, 23, 550–579.

Feindouno, S. and M. Goujon (2016): "Retrospective Economic Vulnerability Index: 2015 update," *Ferdi Working Paper*, 147.

Fenochietto, R. and C. Pessino (2013): "Understanding Countries' Tax Effort," *IMF Working Paper*, No. 13/244, 1–31.

Goujon, M. and L. Wagner (2016): "Policy Performance: Is It Weaker in the Least Developed Countries?" *Forthcoming in Patrick Guillaumont (Ed), Out of the Trap*, chapter 2.

Knack, S. (2009): "Sovereign rents and quality of tax policy and administration," *Journal of Comparative Economics*, 37, 359–371.

Mahdavi, S. (2008): "The level and composition of tax revenue in developing countries: Evidence from unbalanced panel data," *International Review of Economics & Finance*, 17, 607–617.

Mansour, M. (2014): "A Tax Revenue Dataset for Sub-Saharan Africa: 1980-2010," *FERDI Working Paper*, I19.

Moore, M., S. Unsworth, C. Knowles, and N. Hickman (2007): *How does taxation affect the quality of governance?*, vol. 280, Institute of Development Studies at the University of Sussex.

Morrissey, O., C. Von Haldenwang, A. Von Schiller, M. Ivanyna, and I. Bordon (2016): "Tax revenue performance and vulnerability in developing countries," *The Journal of Development Studies*, 52, 1–15.

Prichard, W. (2016): "Reassessing Tax and Development Research: A New Dataset, New Findings, and Lessons for Research," *World Development*, 80, 48–60.

Prichard, W., J.-F. Brun, and O. Morrissey (2013): "Donors, Aid and Taxation in Developing Countries–An Overview," *ICTD Research in Brief*, 4.

Prichard, W., A. Cobham, and A. Goodall (2014): "The ICTD Government Revenue Dataset," *ICTD Working Paper*, 19.

Von Haldenwang, C. and M. Ivanyna (2015): "Vulnerability of tax revenue in resource-rich countries," *Available at SSRN: https://ssrn.com/abstract=2567732 or http://dx.doi.org/10.2139/ssrn.2567732*.

Von Haldenwang, C., O. Morrissey, M. Ivanyna, I. Bordon, and A. Von Schiller (2013): "Study on the Vulnerability and Resilience Factors of Tax Revenues in Developing Countries. Study Funded by the European Commission," *AETS: Brussels*.

Yohou, H. D., M. Goujon, and W. Ouattara (2016): "Heterogeneous Aid Effects on Tax Revenues: Accounting for Government Stability in WAEMU Countries," *Journal of African Economies*, 25, 468–498.

Appendix

List of the countries: Afghanistan, Angola, United Arab Emirates, Argentina, Antigua and Barbuda, Burundi, Benin, Burkina Faso , Bangladesh, Bahrain, Belize, Bolivia, Brazil, Barbados, Brunei, Bhutan, Botswana, Central African Republic, Chile, China, Cote d'Ivoire, Cameroon, Congo Republic, Colombia, Comoros, Cabo Verde, Costa Rica, Cuba, Cyprus, Djibouti, Dominica, Dominican Republic, Algeria, Ecuador, Egypt, Fiji, Gabon, Ghana, Guinea, The Gambia, Guinea-Bissau, Equatorial Guinea, Grenada, Guatemala, Honduras, Haiti, Indonesia, India, Iran, Iraq, Jamaica, Jordan, Kenya, Cambodia, Kiribati, Korea Republic, Kuwait, Lebanon, Liberia, Libya, St. Lucia, Sri Lanka, Lesotho, Morocco, Madagascar, Maldives, Mexico, Mali, Mongolia, Mozambique, Mauritania, Mauritius, Malawi, Malaysia, Namibia, Niger, Nigeria, Nicaragua, Nepal, Oman, Pakistan, Panama, Peru, Philippines, Palau, Papua New Guinea, Paraguay, Qatar, Rwanda, Saudi Arabia, Senegal, Solomon Islands, Sierra Leone, El Salvador, Sao Tome and Principe, Suriname, Swaziland, Seychelles, Syria, Chad, Togo, Thailand, Tajikistan, Tonga, Trinidad and Tobago, Tunisia, Turkey, Tuvalu, Tanzania, Uganda, Uruguay, Venezuela, Vietnam, Vanuatu, Samoa Yemen, South Africa, Congo Democratic Republic, Zambia and Zimbabwe.

Table 4: Non-resource taxes as % of non-resource GDP (log), Fixed effects Model

	Usual Models				Vulnerability-adjusted			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Per capita Income	0.276***	1.206***	0.188***	1.003***	0.118***	0.593***	0.084***	0.562**
	(0.02)	(0.22)	(0.02)	(0.22)	(0.03)	(0.23)	(0.03)	(0.23)
Resource Tax revenue	-0.009***	-0.008***	-0.009***	-0.009***	-0.008***	-0.008***	-0.009***	-0.008***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Manufacture	0.010***	0.010***	0.009***	0.009***	0.012***	0.011***	0.010***	0.010***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Importgdp	0.004***	0.003***	0.003***	0.003***	0.003***	0.003***	0.002***	0.002***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Per capita Income square		-0.055***		-0.048***		-0.027**		-0.028**
		(0.01)		(0.01)		(0.01)		(0.01)
Agriculture			-0.011***	-0.011***			-0.007***	-0.008***
			(0.00)	(0.00)			(0.00)	(0.00)
Human Asset Index					0.008***	0.007***	0.006***	0.006***
					(0.00)	(0.00)	(0.00)	(0.00)
Economic Vulnerability Index					-0.006***	-0.006***	-0.004***	-0.004***
					(0.00)	(0.00)	(0.00)	(0.00)
Constant	0.216	-3.671***	1.222***	-2.203**	1.273***	-0.719	1.763***	-0.244
	(0.19)	(0.93)	(0.22)	(0.93)	(0.22)	(0.98)	(0.24)	(0.98)
Observations	2381	2381	2381	2381	2317	2317	2317	2317
R^2	0.107	0.115	0.135	0.141	0.145	0.147	0.157	0.159

"Sur quoi la fondera-t-il l'économie du monde qu'il veut gouverner? Sera-ce sur le caprice de chaque particulier? Quelle confusion! Sera-ce sur la justice? Il l'ignore."

Pascal

FERDI

Created in 2003 , the **Fondation pour les études et recherches sur le développement international** aims to promote a fuller understanding of international economic development and the factors that influence it.

Contact
www.ferdi.fr
contact@ferdi.fr
+33 (0)4 73 17 75 30