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Alice Sanna and Marcel Gerard

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Abstract

Taxation is the subject of much theoretical, empirical and policy oriented research; and it is a powerful tool for domestic resource mobilization in order to reinforce ownership of public policy and to achieve financial autonomy. Against that framework we want to test whether the level of development and the quality of governance, next to other indicators and control variables, increase the efficiency of the Value Added Tax (VAT) device. Therefore, we use a database of 154 countries, of which 41 are African, observed over a six-year period. Both our cross-sectional study and our panel data analysis show that an increased quality of governance and a higher level of development are key drivers of VAT efficiency, at least up to a threshold of development. Although the paper focuses on VAT, results are likely to hold for a larger range of taxes.

Keywords: Taxation; Value Added Tax (VAT); Tax Efficiency; Governance Quality.

JEL: H20

¹ Authors are economists with a background in public finance and in applied development economics respectively, which could impact their position in the spectrum of scientific studies of the efficiency of tax designs and governance. Authors are indebted to Barbara Dettori and Andrea Piano Mortari for useful technical suggestions and to Assaad El Akremi and anonymous referees from the African Tax Research Network (ATRN) for valuable comments and remarks.

ALICE SANNA

*Louvain School of Management, Université catholique de Louvain, 1 place des doyens,
B-1348 Louvain-la-Neuve, BELGIUM*

alice.sanna@uclouvain.be

MARCEL GERARD

*Louvain School of Management, Université catholique de Louvain, 1 place des doyens,
B-1348 Louvain-la-Neuve, BELGIUM*

marcel.gerard@uclouvain.be

1. Introduction

A goal of many governments is to collect enough revenue domestically, while still being attractive for foreign investments. In particular, for developing countries, and on top of them for African countries, mobilization of more domestic resources is one of the most important strategies to reinforce domestic ownership of public policy and to achieve financial autonomy. Taxation is the main tool to mobilize resources and, for that reason, it is the topic of much theoretical, empirical and policy-oriented research.

The success of that mobilization depends on the efficiency of the tax system. In this paper we want to answer the following research question: can we statistically establish and assess the relation between the efficiency of the Value Added Tax on the one hand, and the quality of governance and the level of development on the other hand? In other terms we want to test whether the level of development and the quality of governance, next to other indicators and control variables, increase the efficiency of the Value Added Tax (VAT) device. Therefore, we use a database of 154 countries, of which 41 are African, observed over a six-year period. Both our cross-sectional study and our panel data analysis show that an increased quality of governance and a higher level of development are key drivers of VAT efficiency, at least up to a threshold of development. Thus, we end up with an economic and econometric support for the quality of governance being an important driver of VAT efficiency, next to the level of development and the openness of the economy. That observation in turn supports our policy recommendation. Notice that, although the paper focuses on VAT, results are likely to hold for a larger range of taxes.

In the rest of the paper, Section 1.1 and Section 1.2 set forth the problem at stake and the research objective respectively. Section 2 is dedicated to a literature review. Section 3 presents the database, first the measure of VAT efficiency – Section 3.1 – and then the independent variables including the governance quality indicators – Section 3.2. A first illustration of the link between VAT efficiency, governance quality, and belonging to a specific group of countries is presented in Section 4. Then Section 5 is devoted to the methodology of our econometric analysis, and Section 6 to the presentation of the results, first those obtained from a cross-sectional study – Section 6.1 – and then those based on a panel data analysis – Section 6.2. Finally Section 7 concludes the study;

it is developed along three lines: policy recommendations – Section 7.1. –, limits of our approach – Section 7.2. – and avenues for further researches – Section 7.3.

1.1. The Problem at Stake

As stated above the success of revenue mobilization depends on the efficiency of the tax system. We focus on that of a specific part of that system, the Value Added Tax; that issue is at the root of our motivation and our research objective.

Our choice for VAT rather than for another tax instrument is justified by the fact that VAT is used by a very large number of countries and obeys a rather homogeneous design. Moreover, in most countries, VAT represents one of the main sources of government revenue.

1.2. Research Objective

Our contribution, definitely empirically oriented, builds up on our experience with tax and jurisdiction interdependence (Gérard *et alii*, 2010; van Malderen and Gérard, 2013), with quality of governance indicators (Gérard and Ruiz, 2009) and with Value Added Tax, (Garcimartin *et alii*, 2014). It attempts to put together economic development variables like openness and belonging to a certain group of countries determined by income level, and governance quality to assess the efficiency of the Value Added Tax. As already mentioned our research question is the following: can we statistically establish and assess the relation between the efficiency of the Value Added Tax on the one hand, and the quality of governance and the level of development on the other hand?

2. Literature Review

Theoretical research in taxation is mostly nested in the framework of models of horizontal and vertical tax interdependence, competition and coordination. In that framework horizontal refers to relations between jurisdictions acting at the same level of power, while vertical refers to different levels of power like in federal countries. References in the economic literature are abundant, they

include Bucovetski (1991) and Wilson (1999) among many contributions; more specifically on levies on consumption expenditures, let us mention Kanbur and Keen (1993).

Empirical research based on those contributions mostly consists of models of tax design where inter-jurisdictional interdependence may matter, captured by spatial lags, either between statutory tax rates or between tax bases – both possibly synthesized using average or marginal effective tax rates –, next to control and economic country specific variables like inter-jurisdictional differences in country size, age of the population, GDP per capita, budgetary needs, openness to international investment and multinational firms, and core-periphery arguments (Besley et al., 2001, Brueckner, 2003). That kind of empirical investigation allows researchers to assess the relative role of the above mentioned determinants, including the importance of various forms of interjurisdictional differences and similarities.

Moreover, theoretical models now make a distinction between tax and yardstick competition, although distinguishing between them is an uneasy issue addressed by several authors including Bordignon *et alii* (2003). That distinction paves the way for a new political economy.

Indeed, a line of research developed which relates political variables and economic arguments, founding that new political economy. That line includes capturing the effect of lobbying, and of quality and form of governance (Bardhan and Mookherjee, 2000, Campos and Giovannoni, 2007). Close to our purposes, Busse and Hefeker (2007) explore the links between political risk, institutions, and foreign direct investment (FDI) inflows. For a data sample of 83 developing countries covering 1984 to 2003, those authors identify most influential factors for the activities of multinational corporations, showing that government stability, internal and external conflict, corruption and ethnic tensions, law and order, democratic accountability of government, and quality of bureaucracy are highly significant determinants of foreign investment inflows. Kolstad and Villanger (2008) use industry level data from 57 countries over the period 1989 – 2000 to examine determinants of FDI flows in services. In their study, institutional quality and democracy appear to be more important than investment risk or political stability. Moreover, democracy influences FDI to developing countries only, suggesting that the absence of democracy is detrimental to investment

below a certain threshold. Consistent with the observation that many services are non-tradable, service FDI is market seeking and unaffected by trade openness.

3. The Data Base

To conduct our empirical analysis we have cross-sectional and panel data for 154 countries of which 41 are African, observed over the period 2007 - 2012. We do not take into consideration countries that do not use VAT.

Thereafter we first focus on the dependent variable, an indicator of VAT efficiency; then we turn to the independent variables.

3.1. VAT Efficiency

We capture the efficiency of the Value Added Tax (VAT), our dependent variable, by the ratio between the average effective and standard statutory VAT rates in the jurisdiction at stake; we measure the former – the effective rate – using the ratio between VAT revenue and VAT base, that latter being approximated by aggregate consumption; the latter – the standard statutory rate – comes from the US aid database.²

Formally, denoting the efficiency statistics by e_i , where the subscript i refers to the country at stake, we have

$$e_i = \frac{\text{Effective Rate}}{\text{Standard Statutory Rate}} = \frac{\text{Effective Revenue / Tax Base}}{\text{Standard Statutory Rate}} \quad (1)$$

If, for example, VAT effective revenue represents 5% of private consumption – the VAT base – although the standard statutory VAT rate amounts to 20%, then VAT Gross Compliance Ratio or Efficiency (VATGCR) is of 25%; therefore what we call VAT Gross Compliance Ratio or VAT Efficiency (VATGCR) is actual VAT revenue as percentage of potential VAT revenue, i.e. the

² USAID, Collecting Taxes Database: Work Cited and References (Years: 2012/13-2011/12-2010/11-2009/10-2008/09-2007/08).

revenue of VAT collection if all goods and services are effectively subject to the standard statutory rate of 20% and no consumption item escaped the tax. Therefore we have that $0 \leq e \leq 1$.

Our choice is supported by some recent work in the field, like OECD (2012) and Cuceu (2014). For that latter “a VAT system should be considered, in absolute terms, efficient when it covers the whole of the potential tax base at a single rate and where all the tax due is collected by the tax administrations”. Cuceu further argues that “full efficiency is attained when the real tax base perfectly covers the potential tax base, a uniform single VAT rate is applied and the entire due VAT is collected by the fiscal public administrations”.

That measure takes into account that VAT mostly applies to final domestic consumption. Therefore, it might be seen then as a somewhat "tighter" indicator of performance. Moreover, it considers as inefficiency any depart from the standard statutory rate applied to the largest possible tax base. That point of view doesn't distinguish between two forms of inefficiency: one comes from a lack of ability as to the collection, control and management of the tax; the other is due to the fact that some goods benefit from reduced rates or are not subject to VAT at all. Subjection to a reduced rate or non-subjection at all needs to be considered carefully. Indeed, it may be due to the willingness of public authorities to realize an arbitrage between efficiency and equity in the design of the tax and in the distribution of its burden, or to favour some industries, in the framework of clearly founded and documented policy choices. But it may be due also to the discretionary power of the authorities or even of the administration or organization in charge of VAT, under pressure of lobbies and other interest groups. Disentangling those elements is unfortunately beyond the capacity of our database; it is however an invitation to enrich both the database and the study using e.g. information as to the volatility of subjection to the standard rate, some reduced rates and possibly zero rates.

3.2. Independent Variables

We divide our set of possible explaining or independent variables into three subsets. The first one consists of country specific economic and control variables traditionally associated to the assessment of tax designs; those variables include the population size of the country, its degree of openness measured by the share of exports and imports in the GDP, GDP per capita, belonging of a given group of countries based on either the level of income or on geographic proximity; figures

for those variables come from the World Bank database (see Table 2 for details). Let such variables be noted x_{ki} where the first subscript refers to the variable and the second one to the country at stake.

The second subset of variables aims at capturing possible interdependence between neighbouring jurisdictions, translated into a spatial lag effect; then we assume that increased efficiency in one jurisdiction can boost efficiency in its neighbours. That second set thus consists of VAT efficiency abroad, denoted by e_{ji} ; here the first subscript refers to a neighbouring country and the second one again to the country at stake, and we denote by $\bar{e}_i$ the average VAT efficiency of neighbouring countries.

Finally, specific to our approach is the use of a third subset of independent variables: governance quality indicators. The World Bank provides those World Governance Indicators (WGI).³ Their respective value goes up from -2.5 up to +2.5. We use six such indicators: (1) Voice and Accountability; (2) Political Stability and Absence of Violence; (3) Government Effectiveness; (4) Regulatory Quality; (5) Control of Corruption; and (6) Rule of Law. Those indicators however are strongly correlated as shown in Table 1; therefore we decided to use their average value, thereafter denoted g_i where again the subscript i refers to the country under consideration. Attempts with other indicators, like the form of government, got little success, so that we decided not to use them in the study, at least tentatively.

Table 1. Correlation between governance quality indicators						
	(1)	(2)	(3)	(4)	(5)	(6)
(1)	1.00					
(2)	0.74	1.00				

³ The six aggregate indicators are based on 31 underlying data sources reporting the perceptions of governance of a large number of survey respondents and expert assessments worldwide. Details on the underlying data sources, the aggregation method, and the interpretation of the indicators, can be found in the WGI methodology paper: Kaufmann, Kraay and Mastruzzi (2010); http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1682130

(3)	0.86	0.71	1.00			
(4)	0.84	0.65	0.93	1.00		
(5)	0.87	0.77	0.96	0.92	1.00	
(6)	0.85	0.75	0.93	0.87	0.96	1.00

Source: own computation

To sum up, Table 2 lists the data we use, making a distinction between dependent and independent variables.

At this stage the following equation summarizes our investigation,

$$e_i = \beta_0 + \sum_k^K \beta_k x_{ki} + \gamma \bar{e}_i + \delta g_i + u_i \quad (2)$$

The variables at work in that equation have been defined above; in addition Greek letters depict coefficients to be estimated and u stand for the residual. That equation will be estimated for the sole year 2012 on the one hand, thus following a cross-sectional approach; and on the entire 2007-2012 entire panel data set.

However, before proceeding to the econometric analysis, we propose a descriptive approach of the link between the efficiency of VAT, the indicators of governance quality and belonging to a specific group of countries characterised geographically or in terms of income level.

Table 2 – Data Description, Statute and Source

NAME and STATUTE	DESCRIPTION	SOURCE
<u>Dependent Variable</u>		
VATGCR	VAT efficiency	USAID
<u>Independent Variables</u>		
POP	Total population	WB
OPENNESS	(Exports + Imports)/(GDP)	WB
GDP	GDP per capita PPP current \$ (World Bank)	WB
INCOME	Low, Lower Middle, Upper Middle, High	WB

<i>REGION</i>	Latin America & Caribbean, Europe, Central Asia, South Asia, East Asia and Pacific, Middle East & North Africa, Sub-Saharan Africa	WB
<i>OECD</i>	OECD member: yes/no	Ours
<i>MEANWGI</i>	Mean of WGI world governance indicators	WGI

4. Descriptive Overview

In this section we propose a first illustration of the link between VAT efficiency, governance quality and belonging to a group of countries sharing a common geographic area, a category of income, or a specific level of – or road to – development like the OECD member states or the BRIC's.

Let us now start inspecting Figures 1 to 4. Geographic areas at stake are Sub-Saharan Africa, Middle East and North Africa, South Asia, Central Asia – which includes some less developed European countries –, East Asia and Pacific, Europe, and Latin America and Caribbean.⁴ Categories of income are low income countries, lower middle-income countries, upper middle-income countries and high income countries respectively, as well as OECD and BRIC's. Figures are for year 2012.

The distribution of VAT efficiency per geographic area (Figure 1) contrasts relatively inefficient South Asia – a region which comprises no High Income country – and especially efficient East Asia and Pacific area – which includes High Income Countries like Korea, Japan, Taiwan, Singapore, Australia, and New Zealand. Africa – both Sub Saharan Africa and North Africa associated to Middle East – are in between.

Ranking countries by level of income (Figure 2) sets forth the inefficiency of VAT in Low Income countries as opposed to the other three categories, as well as the efficiency gap between OECD countries and non-OECD countries on the one hand (Figure 3), and between BRIC's and other countries on the other hand (Figure 4).

Moreover, Figure 2 reveals that the efficiency gain is higher when one moves from the Low Income

⁴ Appendix A gives the composition of each of those group of countries.

group to the Lower Middle Income one than from that latter group to the Upper Middle Income category – the gain amounts to 69 per cent in the former case against only 2 percent in the latter, see the bottom half of Table 3, figures for year 2012 – or from the Upper Middle Income category to the High Income one.

Based on the top half of Table 3 we may compute a simple correlation coefficient between the measure of VAT efficiency and the mean value of governance quality indicators. We do the exercise for the year 2012 and for the mean values over the whole panel, thus for the period 2007- 2012. The former is in line with the cross-sectional approach of the econometric analysis, the latter with the one using panel data, see below. In both case the magnitude of the correlation is close to 60 per cent.

Those observations seem to support the view that both governance quality and development are correlated and improve the efficiency of VAT. However, the marginal efficiency gain is much higher when a country moves from the Low Income group to the Lower Middle Income one than in other cases. Especially moving from the Upper Middle Income group to the High Income one is associated with a large increase in governance quality (about 50 per cent) but with a smaller one in VAT efficiency (4 per cent) – see Table 3, lower part. Therefore, we suggest that development favours governance quality and VAT efficiency together but up till a threshold.

Though our research question is different, that observation echoes Kolstad and Villanger (2008) study mentioned in the literature review, that the absence of democracy is detrimental to investment below a certain threshold.

Notice that East Asia and Pacific region high level of efficiency is to be related to the especially high level of heterogeneity of that area – 6 countries out of 22 are ranked High Income, see Appendix A – and thus to some catch up effect for several countries of the region. In the next two sections we will check whether the econometric analysis confirms all those results.

Figure 1. VAT efficiency by geographic area

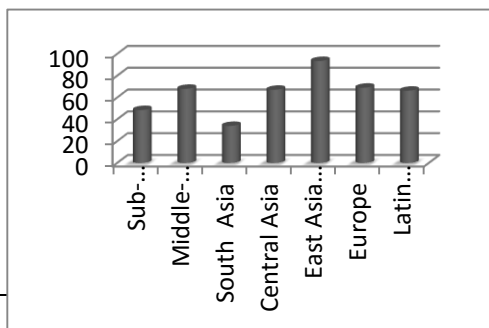


Figure 2. VAT efficiency by income level

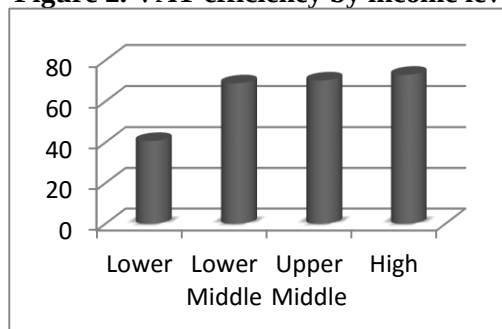


Figure 3. VAT efficiency and OECD membership

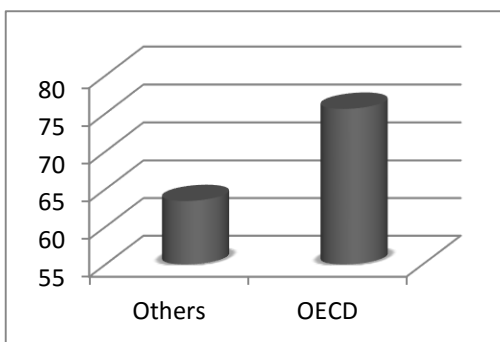


Figure 4 . VAT efficiency and BRIC membership

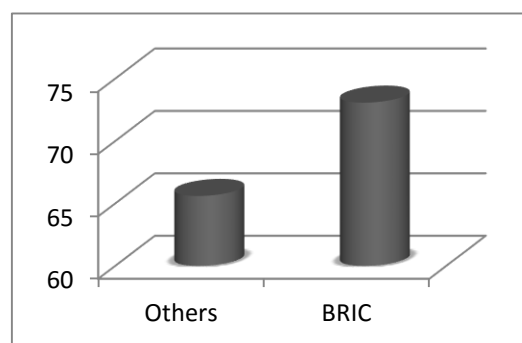


Table 3 – VAT Efficiency and WGI

Table 3 – VAT Efficiency and WGI					
Year 2012			Panel 2007 - 2012		
MEAN WGI (-2.5; 2.5)		VAT Efficiency	MEAN WGI (-2.5; 2.5)		
				VAT Efficiency	
REGION					
Sub-Saharan Africa		-0.54	48,52	-0.38	52.53
Variance in italics			0.40	755.11	

Middle-East and North				
Africa	-0.37	67.98	-0.53	66.12
			0.45	201.03
South Asia	-0.88	33.94	-0.88	33.94
			0.23	446.23
Central Asia	-0.56	67.09	-0.58	64.02
			0.16	255.21
East Asia and Pacific	0.12	93.47	0.00	93.95
			0.65	2482.60
Europe	0.94	68.98	0.79	67.98
			0.53	251.88
Latin America and Caribbean	0.04	66.24	0.08	64.73
			0.39	513.40
INCOME LEVEL				
Low	-0.83	40.70	-0.83	40.70
			0.13	335.92
Lower Middle	-0.46	68.76	-0.27	70.87
			0.33	1543.18
Upper Middle	-0.12	70.18	-0.20	67.40
			0.24	531.46
High	1.05	72.96	1.05	72.96
			0.42	639.37
OECD	1.26	63.42	1.26	75.60
			0.21	547.00
Others	-0.30	75.60	-0.26	64.49
			0.40	1016.73
BRIC	-0.40	65.60		
Others	0.01	73.07		

5. Econometric Analysis, Methodology

Our econometric methodology combines the use of traditional control variables, governance quality indicators and possibly interdependence across countries, allowing us to introduce as drivers of VAT efficiency in a jurisdiction, not only jurisdiction specific variables but also peer effects

through neighbouring countries. We are then in line with panel data and spatial lags econometrics with due weights and impact through the intercept and the slope of the reaction functions (Allers and Elhorst, 2010, and Anselin, 1988).

However, we proceed step by step. First – see Table 4 – we estimate different versions of

$$e_i = \beta_0 + \sum_k^K \beta_k x_{ki} + \delta g_i + u_i \quad (3)$$

using cross-section data for the year 2012; equation (3) is identical to equation (2) except that interdependence among countries has been removed. Then we introduce a one-period time lag for the governance quality indicators, thus taking into account figures for 2011 instead of 2012, in order to check the quality of the results.

In the second step, taking into account the outcome of the first step, we repeat the estimations for the entire panel 2007-2012, see Table 5.

Finally, we test the opportunity of introducing inter-jurisdictional effects through spatial lags. Therefore, we use the Moran test; its p -value of 0.445 – see Appendix B2 – suggests that there is no spatial effect at work in our analysis, so that there is no need to call for models including spatial lags. In other words we give up introducing the term $\gamma \bar{e}$ of equation (2).

6. Econometric Analysis, Results

In this section we successively report and comment on the results obtained from both the cross-sectional approach and the panel data analysis.

6.1. Results, cross-section approach

Results obtained from the cross-sectional approach are reported in Table 4. That table consists of 8 columns. The first one reports results from the simplest model we use, based on a constant and country specific variables: governance quality, population size, openness and per capita GDP.

In columns (2) to (4) we add belonging to either the OECD or the BRIC group of countries, taken separately or taken together; therefore, we use dummy variables. In column (5) we substitute

belonging to those two groups withy belonging to a group of countries characterized by a level of income. In columns (6) the substitution is with belonging to a region of the world; for the grouping of countries, see Table 1, Table 2 and Appendix A.

Finally, in column (7) we keep only the independent variables which revealed to be the most significantly different from zero, and we introduce a one-period lag for the governance quality indicator.

Across the whole estimation, Low Income countries and Sub-Saharan Africa are taken as benchmarks. Figures for North America are not reported since that group consist of a single country.

Noticeable in Table 4 is the high level of significance of both the constant and the governance quality. It turns out, based on column (1), that a badly ruled country will exhibit a VAT efficiency⁵ of $56.10 + 14.85 (-2.5) = 18.98$ while a top ruled one will exhibit an efficiency rate of $56.10 + 14.85 (2.5) = 93.23$. Of course those figures are just orders of magnitude but they are appealing: governance has a positive effect on VAT efficiency (significance at 1%).

If we now turn to column (5) we see that moving from the Low Income group to the Lower Middle Income group increases the VAT efficiency of the country from 45.48, the value of the constant, $+ 14.33 (-0.83) = 33.59$ to $45.48 + 14.33 (-0.46) + 16.82 = 55.71$, which means a gain of 66 per cent; notice that corresponding actual figures are provided in Table 3 and amounts to 40.70 and 68.76 respectively, i.e. a difference of 69 per cent. In contrast a further increase in the development scale, up to the Upper Middle Income group only produces a 10 per cent gain: from 55.71 to $45.48 + 14.33 (-0.12) + 17.56$.

Otherwise, if we compare Sub Saharan Africa and the Latin America Caribbean region, efficiency goes up from 43.79, the constant in column 6, $+ 11.01 (-0.54) = 37.84$ to $43.79 + 11.01 (0.04) + 17.07 = 61.30$, an increase of 62 per cent, to be compared with real figures given by Table 3, 48.52 and 66.24.

⁵ Remember that the lower and upper bounds of the governance quality indicators are -2.5 and +2.5 respectively.

Table 4. Cross-section regressions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		17.31**					
	14.85***	*	15.07**	17.30**	14.33**	11.01**	8.89***
Governance	(0.002)	(0.001)	*(0.001)	*(0.001)	*(0.006)	(0.020)	(0.003)
	0.00	0.01	0.00	0.00	0.00	0.00	
Population	(0.211)	(0.240)	(0.728)	(0.655)	(0.364)	(0.295)	
	12.24**	9.25	12.55**	9.66	9.21	11.59	9.86**
Openness	(0.048)	(0.164)	(0.044)	(0.151)	(0.151)	(0.047)	(0.056)
	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	
Per Capita GDP	(0.406)	(0.895)	(0.373)	(0.835)	(0.857)	(0.268)	
		-13.16		-23.26			
OECD		(0.231)		(0.274)			
			14.51	10.11			
BRIC			(0.513)	(0.653)			
Middle East & North Africa						15.74 (0.159)	
						-8.98	
South Asia						(0.469)	
						21.24**	
Central Asia						(0.018)	
East Asia & Pacific						35.91**	29.81**
						*(0.000)	*

						(0.000)	
						12.89	
Europe						(0.171)	
Latin America & Caribbean						17.07**	
						(0.027)	
Lower Middle Income					16.82**		
					(0.046)		
Upper Middle Income					17.56**		
					(0.053)		
					5.22		
High Income					(0.728)		
Constant (p-value	58.72**	56.20**	58.60**	45.48**	43.79**		
0,000)	56.10***	*	*	*	*	*	51.01**
Nb obs (R-	123	123	123	123	123	123	115
squared)	123 (0.18)	(0.19)	(0.15)	(0.15)	(0.23)	(0.36)	(0.29)

It turns out that better governance and economic development significantly drive up the efficiency of VAT and thus of an important section the tax system. Moreover, as already suggested at the end of the descriptive overview – see Section 2 above – a threshold effect in line with Kolstad and Villanger (2008) seems to be at work.

6.2. Results, panel data analysis

We now move to the results obtained with panel data for the period 2007 – 2012. As for the cross-section estimations for the sole year 2012, we rule out spatial lags, a decision based on Moran test. Results are given in Table 5. They have been produced using three estimation techniques but we decided to privilege Random Effects (RE) over Fixed (FE) or Between Effects (BE).

Indeed, according to the literature, models with Random Effects are the most used models for longitudinal (or Panel) data set. Although Fixed Effects regression is a model that controls for omitted variables which differ across individuals or regions but are constant over time, Between

Effects regression controls for omitted variables changing over time but constant across individuals. Random effects regression is a weighted average of Fixed and Between Effects.

The most accepted way for choosing between those three approaches is to run a Hausman test – see Appendix B1. From a statistical point of view, Fixed Effects always give consistent results but they may not produce the most efficient models. Random Effects, generating more efficient estimators, will generally provide better *p*-values. In the Hausman test, we test the null hypothesis that the coefficients estimated by efficient Random Effects estimators are the same as those estimated with consistent Fixed Effects estimators.

As in our case $\text{Prob} > \chi^2 = 0.7970$ (larger than 0.05) the best model is that with Random Effects and we focus on the RE columns of Table 5 in the rest of the section. Columns (1) of Table 5 correspond to column (1) of Table 4; columns (2) of Table 5 replicate column (4) of Table 4; columns (3) of Table 5 correspond to column (5) of Table 4; and columns (4) of Table 5 to column (6) of Table 4.

All in all, we observe that the coefficients that were significantly different from zero in Table 4 still are when we move to panel data. It turns out that panel data results corroborate previous ones. Moreover, some coefficients which were not, or not always, significantly different from zero in Table 4, now are significantly different from zero; as a consequence, moving from 123 cross-sectional observations to a 717 panel data analysis reinforces the strength of the results.

Table 5. Panel regressions

	(1) RE	(1) FE	(1) BE	(2) RE	(2) BE	(3)RE	(3)BE	(4)RE	(4)BE
Governance	9,78*** (0,001)	13,54 (0,117)	11,15*** (0,001)	12,07*** (0,000)	12,96*** (0,001)	9,31*** (0,002)	9,64*** (0,004)	8,91*** (0,004)	9,94*** (0,005)
Population	0,00 (0,657)	0,00*** (0,006)	0,00 (0,779)	0,00 (0,750)	0,00 (0,536)	-1,64 (0,867)	-4,04 (0,680)	0,00 (0,566)	0,00 (0,665)
Openness	11,31*** (0,001)	8,49 (0,147)	13,38*** (0,001)	9,90** (0,005)	12,03*** (0,008)	8,76*** (0,006)	9,91*** (0,011)	9,83*** (0,002)	11,27*** (0,004)
Per Capita GDP	0,00 (0,713)	0,00 (0,373)	-0,00 (0,773)	0,00 (0,396)	0,00 (0,944)	0,00 (0,696)	-0,00 (0,767)	-0,00 (0,752)	-0,00 (0,379)

				-9,55	-6,97				
OECD				(0,159)	(0,337)				
				11,83	15,51				
BRIC				(0,433)	(0,306)				
Middle East &North							20,09***	20,31***	
Africa							(0,004)	(0,004)	
							-12,36	-12,29	
South Asia							(0,165)	(0,171)	
							20,13***	20,43***	
Central Asia							(0,001)	(0,001)	
							23,88***	23,81***	
East Asia &Pacific							(0,000)	(0,000)	
							13,33**	14,29**	
Europe							(0,019)	(0,015)	
Latin America &							14,54***	14,53***	
Caribbean							(0,004)	(0,004)	
						23,58***	23,66***		
Lower Middle Income						(0,000)	(0,000)		
						25,61***	26,87***		
Upper Middle Income						(0,000)	(0,000)		
						15,96**	19,82**		
High Income						(0,050)	(0,022)		
	48,90***	11,18	48,88***	50,77***	50,52***	33,28***	33,00***	40,42***	40,64***
Constant	(0,000)	(0,441)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)

*** significance 1% (*p*-values are indicated between parentheses under the coefficients), **5%, *10%

We may also repeat the computations of forecasted efficiency conducted in the cross-sectional approach above, now using panel data outcome and the last two columns of Table 3. The first computation was based on column (1) of Table 4; here it is based on column (1) RE of Table 5. For a badly ruled country the model predicts a VAT efficiency of $48.90 + 9.78 (-2.5) = 24.45$ while for a perfectly ruled one the corresponding figure amounts to 73.35.

If we turn to column (3) RE we observe that moving from the Low Income group to the Lower Middle Income group increases the VAT efficiency of the country from $33.28 + 9.31 (-0.83) = 25.55$ to $33.28 + 9.31 (-0.27) + 23.58 = 54.35$, which means a gain of 113 per cent. Further move to the Upper Middle Income group has a much smaller effect, the efficiency gain doesn't exceed 5 per cent (57.03 instead of 54.35).

If again we compare Sub Saharan Africa and the Latin America Caribbean region – see column (4) RE – efficiency goes up from $40.42 + 8.91 (-0.38) = 37.03$ to $40.42 + 8.91 (0.08) + 14.54 = 55.67$, an increase of 50 per cent.

6.3. Conclusion of the econometric analysis

It turns out from both the cross-sectional and the panel data analysis that an increased quality of governance and a higher level of development, captured by the country reaching a higher level of income, experiencing a larger openness of its economy or aligning on countries benefiting from a more favourable geographical position in the world – see especially the East Asia and Pacific area which can be read as an alternative way to benefit from stimulating peer or neighbour effects – are important drivers of VAT efficiency. However, those positive effects are clearly and importantly at work where a country is able to move from the least favourable group to that just above; the effect is much smaller once a country is higher ranked, denoting some threshold effect like that suggested by Kolstad and Villanger (2008) in a different but related context.

In contrast, the Moran test has shown that directly introducing interjurisdictional peer effects through spatial lags is not a successful method in this study: that test suggests that spatial lags effects are not at work in our analysis.

7. Conclusions

This final and concluding section will develop along three lines: policy recommendations, limits of the approach used in the paper, and avenues for further research. Prior to that let us remember the problem at stake, the research question and the main results that we have obtained.

We know that a goal of many governments is to collect enough revenue domestically and still being attractive for foreign investments. In particular, for developing countries, and on top of them for African countries, moving to more domestic resource mobilization is one of the most important means to reinforce ownership of public policy and achieve financial autonomy. As recalled in the introduction, taxation is the main tool for such mobilization. However, its success depends on the efficiency of the tax system.

Therefore, we test whether governance quality, next to other development indicators and control variables, is a driver of the efficiency of an important section of the tax system, Value Added Tax. For that purposes, we mobilized a data base covering 154 countries of which 41 are African, over the period 2007-2012, to answer the research question: can we statistically establish and assess the relation between the efficiency of the Value Added Tax on the one hand, and the quality of governance and the level of development on the other hand?

It turns out from both the cross-sectional and the panel data analysis that an increased quality of governance and a higher level of development, captured by the country reaching a higher level of income, experiencing a larger openness of its economy or aligning on countries benefiting from a more favourable geographical position in the world – see especially the East Asia and Pacific area which can be read as an alternative way to benefit from stimulating peer or neighbour effects – are key drivers of VAT efficiency.

However, those positive effects are clearly and importantly at work where a country is able to move from the least favourable group to that just above; the effect is much smaller once a country is higher ranked, denoting some threshold effect like that suggested by Kolstad and Villanger (2008) in a different but related context.

In contrast, the Moran test has shown that directly introducing interjurisdictional peer effects through spatial lags is not a successful method in this study: that test suggests that spatial lags effects are not at work in our analysis.

Although the paper focuses on the VAT systems, the results are likely to be valid for a larger range of taxes.

7.1. Policy recommendations

Neither this paper nor its authors want to be lesson givers: our ambition is to provide policy makers with scientifically founded arguments. And there are in the paper. Should a government want to mobilize revenues, like VAT revenues, to reach an increased ownership or autonomy of its economy and policy, especially in a low income Sub-Saharan country, increasing the quality of the governance of the country and managing in such a way that the country becomes more open to world economy, that it moves up to a higher income group and that it mimics peer countries from a better ranked geographic part of the world, is a desirable policy and provides potential economic partners with right signals.

In line with that, such government would take into accounts the various dimensions of governance quality as suggested by the World Bank: Voice and Accountability, Political Stability and Absence of Violence, Government Effectiveness, Regulatory Quality, Control of Corruption and Rule of Law.

7.2. Limits of the study

Econometric modelling is always a simplification of reality and our analysis doesn't escape that issue. Let us then set forth only one shortcoming of our approach. It is related to the ambiguity of the measure that, like many other fellows, we use to capture efficiency. As we have already mentioned in Section 3.1., our measure considers as inefficiency any depart from the standard statutory rate applied to the largest possible tax base. In other words, efficiency is understood in crude economic terms.

We know from economic theory however that we may depart from that position for various reasons. Some are good: differences in demand and supply elasticity or mobility, search for an equitable tax system, which reduces the tax burden on the goods consumed by the poorer. Some are less: equity concern may hide submission of public authorities to private interest groups.

That remark doesn't rule out the interest of the study but it invites to read it with care and it also paves the way for further research.

7.3. Avenues for Further Research

It could be interesting, especially when departs from crude efficiency take the form of the subjection of some goods to a reduced or even a zero VAT rate, to make a distinction between departs which

respond to true efficiency or equity purposes, and those who are related to public authorities' commitment towards private interests.

A useful tool to capture that difference could be a measure of the volatility of the tax rate. When a good frequently enters and leaves a category not subject to the standard rate it is much likely that up's and down's in the tax rate obey lobbying rather than to be the outcome of a wise arbitrage between efficiency and equity.

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Appendix A. Groups of countries

By geographic area (a * indicates a High Income Country; between parenthesis are countries excluded from the study, mainly for statistical or because they do not use VAT; Non-VAT High Income countries have been omitted)

Sub-Saharan Africa: (Angola), Benin, Botswana, Burkina Faso, Burundi, Cabo Verde, Cameroon, Central African Republic, Chad, Comoros, (Congo Dem Rep), Congo Rep, Cote d'Ivoire, (Eritrea), Equatorial Guinea*, Ethiopia, Gabon, Gambia, Ghana, Guinea, (Guinea-Bissau), Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, (Sao Tome and Principe), Senegal, Seychelles*, Sierra Leone, (Somalia), South Africa, (South Sudan), (Sudan), Swaziland, Tanzania, Togo, Uganda, Zambia, Zimbabwe.

Middle East and North Africa: Algeria, (Djibouti), Egypt, Iran, Israel*, (Iraq), Jordan, Lebanon, (Libya), Malta*, Morocco, (Syrian Arab Republic), Tunisia, (West Bank and Gaza), Yemen (Source: <http://data.worldbank.org/region/MNA>)

Europe and Central Asia: (Albania), Armenia, Azerbaijan, Belarus, (Bosnia and Herzegovina), (Bulgaria), Georgia, Kazakhstan, (Kosovo), Kyrgyz Republic, Macedonia FYR, Moldova, Russian Federation*, (Montenegro), (Romania), (Serbia), Tajikistan, Turkey, (Turkmenistan), Ukraine and Uzbekistan (Source: <http://data.worldbank.org/region/ECA>)

Europe: Albania, Austria*, Belgium*, Bulgaria, Croatia*, Cyprus, Czech Rep*, Denmark*, Estonia*, Finland*, France*, Germany*, Greece*, Hungary*, Iceland*, Ireland*, Italy*, Kosovo, Latvia*, Lithuania*, Luxembourg*, Montenegro, Netherlands*, Norway*, Poland*, Portugal*, Romania, Serbia, Slovak Rep*, Slovenia*, Spain*, Sweden*, Switzerland*, United Kingdom* (countries between parenthesis have been omitted)

South Asia: Afghanistan, Bangladesh, (Bhutan), India, (Maldives), Nepal, Pakistan, Sri Lanka
(Source: <http://data.worldbank.org/region/SAS>)

East Asia and Pacific: Australia*, (American Samoa), Cambodia, China, Fiji, Indonesia, Japan*, (Kiribati), (Korea Dem. People's Rep), Korea Rep*, Lao, Malaysia, (Marshall Islands), (Micronesia), Mongolia, (Myanmar), (Palau), New Zealand*, Papua New Guinea, Philippines, Samoa, Singapore*, Solomon Islands, Taiwan China*, Thailand, Timor-Leste, Tonga, (Tuvalu), Vanuatu, Vietnam
(Source: <http://data.worldbank.org/region/EAP>)

Latin America and Caribbean: Antigua and Barbuda*, Argentina*, Barbados*, Belize, Bolivia, Brazil, Chile*, Colombia, Costa-Rica, (Cuba), Domenica, Dominican Rep., Ecuador, El Salvador, Grenada, Guatemala, Guyana, (Haiti), Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, St Kitts and Nevis, St Lucia, St Vincent and the Grenadines, Suriname, Trinidad and Tobago*, Uruguay*, Venezuela* (Source: <http://data.worldbank.org/region/LAC>)

By income level

Low Income: Afghanistan, Benin, Burkina Faso, Burundi, Cambodia, Central African Republic, Chad, Comoros, Congo Dem Rep, Eritrea, Ethiopia, Gambia, Guinea, Guinea-Bissau, Haiti, Korea Dem People's Rep, Liberia, Madagascar, Malawi, Mali, Mozambique, Nepal, Niger, Rwanda, Sierra Leone, Somalia, South Sudan, Tanzania, Togo, Uganda, Zimbabwe (Source: <http://data.worldbank.org/income-level/LIC>)

Lower Middle Income: Armenia, Bangladesh, Bhutan, Bolivia, Cabo Verde, Cameroon, Congo Rep, Cote d'Ivoire, Djibouti, Egypt, El Salvador, Georgia, Ghana, Guatemala, Guyana, Honduras, India,

Indonesia, Kenya, Kiribati, Kosovo, Kyrgyz Rep, Lao, Lesotho, Mauritania, Micronesia, Moldova, Morocco, Myanmar, Nicaragua, Nigeria, Pakistan, Papua New Guinea, Philippines, Samoa, Sao Tome and Principe, Senegal, Solomon Islands, Sri Lanka, Sudan, Swaziland, Syrian Arab Rep, Tajikistan, Timor-Leste, Ukraine, Uzbekistan, Vanuatu, Vietnam, West Bank and Gaza, Yemen, Zambia (Source: <http://data.worldbank.org/income-level/LMC>)

Upper Middle Income: Albania, Algeria, American Samoa, Angola, Azerbaijan, Belarus, Belize, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, China, Colombia, Costa-Rica, Cuba, Dominica, Dominican Republic, Ecuador, Fiji, Gabon, Grenada, Iran, Iraq, Jamaica, Jordan, Kazakhstan, Lebanon, Libya, Macedonia FYR, Malaysia, Maldives, Marshall Islands, Mauritius, Mexico, Mongolia, Montenegro, Namibia, Palau, Panama, Paraguay, Peru, Romania, Serbia, South Africa, St Lucia, St Vincent and the Grenadines, Suriname, Thailand, Tonga, Tunisia, Turkey, Turkmenistan, Tuvalu (Source: <http://data.worldbank.org/income-level/UMC>)

High Income: Antigua and Barbuda, Argentina, Aruba, Australia, Austria, Bahamas, Bahrain, Barbados, Belgium, Bermuda, Brunei Darussalam, Canada, Cayman Islands, Channel Islands, Chile, Croatia, Curacao, Cyprus, Czech Republic, Denmark, Equatorial Guinea, Estonia, Faroe Islands, Finland, France, French Polynesia, Germany, Greece, Greenland, Guam, Hong Kong SAR, Hungary, Iceland, Ireland, Isle of Man, Israel, Italy, Japan, Korea (Rep), Kuwait, Latvia, Liechtenstein, Lithuania, Luxembourg, Macao SAR, Malta, Monaco, Netherlands, New Caledonia, New Zealand, Northern Mariana Islands, Norway, Oman, Poland, Portugal, Puerto Rico, Qatar, Russian Federation, San Marino, Saudi Arabia, Seychelles, Singapore, Sint Maarten (Dutch Part), Slovak Republic, Slovenia, Spain, St Kitts and Nevis, St Martin (French Part), Sweden, Switzerland, Trinidad and Tobago, Turks and Caicos Islands, United Arab Emirates, United Kingdom, United States, Uruguay, Venezuela, Virgin Islands (US) (Source: <http://data.worldbank.org/income-level/HIC>). 0

Appendix B1. Hausman Test

	—— Coefficients ——		(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
	(b) fixed	(B) random		
I	13.53875	9.780788	3.757966	8.060362
pop	8.26e-07	4.81e-09	8.21e-07	2.98e-07
gdpPC	.0004038	.0000666	.0003372	.000415
open	8.849722	11.3119	-2.462178	5.090574

b = consistent under Ho and Ha; obtained from xtreg
 B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

$\chi^2(2) = (b-B)'[(V_b-V_B)^{-1}](b-B)$
 = **0.45**
 Prob>chi2 = **0.7970**

Appendix B2. Moran Test

Diagnostic tests for spatial dependence in OLS regression			
Fitted model			
VATGCR = MeanWGI			
Weights matrix			
Name: diststd			
Type: Distance-based (inverse distance)			
Distance band: 0.0 < d <= 9999999999.0			
Row-standardized: Yes			
Diagnostics			
Test	Statistic	df	p-value
Spatial error:			
Moran's I	0.763	1	0.445
Lagrange multiplier	0.090	1	0.764
Robust Lagrange multiplier	0.000	1	0.988
Spatial lag:			
Lagrange multiplier	0.098	1	0.754
Robust Lagrange multiplier	0.008	1	0.929