

Value-added tax effort

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Abstract

The success of the value-added tax (VAT) towards revenue objectives is limited by the environment within which the VAT operates. Controlling for these environments allows for comparative estimates of countries' VAT efforts. This article provides such estimates for 129 countries with a VAT.

Key words: value-added tax, tax capacity, tax effort, VAT, GST

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1. INTRODUCTION

Many countries require additional revenue from the VAT towards fiscal consolidation and sustained economic development. Cnossen (2015) confirms this argument for African countries, and de Mooij and Keen (2012) for European countries. To obtain such additional revenues, countries should increase their VAT performance.

Three measures of VAT performance are generally used: a VAT to gross domestic product (GDP) ratio, a VAT to total final consumption ratio, and a C-efficiency ratio, which is similar to a VAT to final consumption ratio, but controls for standard rate differences among countries. Although each of these measures is useful, none of them takes into account that the performance of any VAT is limited by the environment within which that VAT operates. This environment is mostly beyond the control of the policy-maker; policy-makers face VAT capacity constraints. One may therefore argue that taking the different VAT capacity constraints of countries into account will offer an improved comparable measure of VAT performance, namely VAT effort.² Following the traditional tax effort approach, I estimate a VAT effort index for 129 countries over a period of 11 years (2004-2014).

The literature on tax effort and VAT performance is relevant for this article. Prominent contributions in the tax effort literature include Lotz and Morss (1967), Bahl (1971), Leuthold (1991), Tanzi (1992), Strotzky and WoldeMariam (1997), Piancastelli (2001), Teera (2002), Alm, Martinez-Vazquez & Schneider (2004), Bahl (2005), and Clist and Morrissey (2011) who use variables representing the economic environment as tax capacity constraints. Following Bird, Martinez-Vazquez and Torgler (2004), demand-side factors such as the political institutional environment have also been included as tax capacity constraints by Gupta (2007), Bird and Martinez-Vazquez (2008), Mkandawire (2010), Pessino and Fenochietto (2010), Le, Moreno-Dodson and Bayraktar (2012), and Fenochietto and Pessino (2013). I also follow Bird, Martinez-Vazquez and Torgler (2004) and include both economic environment and political institutional environment factors as VAT capacity constraints. Similar to Davoodi and Grigorian (2007) I include country and year fixed effects in the analysis.³

In the VAT performance literature, simple cross-country measures of VAT performance – such as VAT to GDP and C-efficiency – are often provided, as for instance by Martinez-Vazquez and Bird (2011) and de Mooij and Keen (2012). Other empirical work considers the effect of having a VAT on total tax performance (Baunsgaard & Keen, 2010; Keen & Lockwood, 2010) and other economic factors such as trade (Feldstein & Krugman, 1990; Hines & Desai, 2005). The most relevant VAT literature for this article is the study by Aizenman and Jinjark (2008) who provide empirical evidence to explain the variation in C-efficiency among countries. However, the aim of this article is not to explain the country variation in VAT performance, but rather to provide an improved measure of comparable VAT performance.

² In my view, C-efficiency remains a better measure of VAT performance for non-comparative purposes. Further, my understanding of the Keen (2013) article is that C-efficiency is not meant to be a comparative measure of VAT performance, although in practice it is often used as one.

³ Year fixed effects will for instance be events that influenced all countries' VAT performance, such as the 2008 financial crisis. Country fixed effects will for instance be the location of the country and the historical background of the country.

This article contributes to the tax literature by providing the first VAT effort index. The regression results on VAT capacity factors, although informative, should be interpreted with caution. Endogeneity bias is not addressed for these results and consistent coefficients are beyond the aim of this article. For empirical results on VAT capacity factors, see Aizenman and Jinjark (2008). The estimated VAT effort index is useful in identifying the potential of countries to increase VAT revenues by either increasing the rate of the tax, broadening the base of the tax or increasing tax compliance.

In the remainder of the article, I first discuss the measurement of VAT performance used and provide *a priori* justifications for the VAT capacity variables included in the models estimated. The regression results used to predict VAT capacity, a VAT capacity index and a VAT effort index then follow.

2. VAT PERFORMANCE

2.1 VAT ratio

The terms VAT ratio, VAT capacity and VAT effort are used similarly to past tax effort studies. For tax effort studies, the tax ratio is almost exclusively calculated as:

$$Tax\ ratio = \frac{TR}{Y} \quad (1)$$

where TR is total tax revenue and Y is GDP. In this equation, GDP is used as an overall indicator of tax capacity (Lotz & Morss, 1967). In this sense, the tax ratio can also be viewed as a tax effort indicator since tax effort can be defined as the extent to which a government raises tax revenues, taking into account its capacity to do so (Advisory Commission of Intergovernmental Relations, 1962). Since the VAT is not intended to be a tax on production, but rather on consumption, there is little reason to consider GDP as an overall indicator of VAT capacity. More specifically, exported goods (included in GDP) are predominantly not taxed under a VAT, while imported goods (excluded from GDP) are taxed under a VAT. Total final consumption is therefore the preferred indicator of overall VAT capacity; the calculation thereof is more consistent with the potential amount of goods and services that can be taxed under a VAT.⁴ For the regression results in this article (used to construct the VAT effort index) the dependent variable, being $VATratio$ can be written:

$$VATratio = \frac{VR}{TCE} \quad (2)$$

where VR is VAT revenue and TCE is total consumption expenditure of households and government. Government consumption is specifically included since many experts argue that goods and services supplied by government entities, public sector bodies, non-profit organisations, charitable organisations and similar tax-exempt bodies can and should be taxed under a VAT.⁵

The other popular measure of VAT performance is C-efficiency ($CEFF$), which can be written as:

⁴ The only exclusion to this statement is the treatment of residential consumption of non-investment goods and services in other jurisdictions. This consumption is included in total final consumption but cannot be taxed under the VAT.

⁵ Refer to de la Feria (2009), Gendron (2010) and Henkow (2013) for further discussion on this.

$$CEFF = \frac{VR}{TCE \times SR} \quad (3)$$

where SR is the standard rate of VAT for each country in the dataset. It would not be sensible to use C-efficiency as the measure of VAT performance in this article since the standard rate of the VAT is not a capacity constraint; it is a tool used to raise VAT effort.⁶ Another potential measure of VAT performance found in the representative tax system literature (Bahl, 1972) would be to use representative VAT as:

$$RepVAT = \frac{\sum_{j=1}^n \left(\frac{VR_{ij}}{TCE} \right)}{n} \quad (4)$$

where n is the sample size. The $RepVAT$ measure therefore indicates the VAT performance of countries if all countries had the same VAT rate. This approach is not followed for purposes of this article since the objective of this article is to obtain the best potential measure of the true tax base in calculating the VAT effort index. In the representative tax system literature the focus is on the specific tax capacity measures and how the obtained coefficients of these measures relate to overall tax capacity (Bahl, 1972).

The data used to calculate the VAT ratio, summarised in Table 1, were obtained from the International Monetary Fund's International Financial Statistics dataset, Government Financial Statistics dataset and World Revenue Longitudinal dataset, the Organisation for Economic Co-operation and Development's National Accounts datasets and many countries' National Accounts and Public Finance Reports (or similar reports).

Table 1: Summary Statistics of VAT Ratio

Variable	N	Mean	Std Dev.	Min	Max
VAT ratio	1187 ⁷	7.779	3.053	0.176	15.995

2.2 VAT capacity

In this section I identify and discuss VAT capacity factors that potentially have a significant influence on VAT performance. To identify VAT capacity factors, I rely on discussions in the theoretical VAT literature suggesting factors that may be expected to influence VAT performance, and also on the empirical VAT literature that considers the determinants of C-efficiency. This literature is discussed under the relevant headings in this section. I refer to tax-effort literature where the VAT literature does not provide adequate guidance.

⁶ For decomposition of C-efficiency, see Keen (2013).

⁷ Outliers were removed from the dataset taking into account their studentised residuals, leverage and Cook's distance. An outlier was only removed in the case where it was apparent that an outlier resulted from a data error.

It is not the intention that the list of capacity factors be exhaustive since many capacity factors will be highly collinear and I do not aim to make arguments of causality based on the results of the estimations performed.

2.2.1 *Political institutions*

[T]he tax level in any country does not just depend on the ability of its tax administration to collect taxes from the available ‘tax handles’. If taxpayers perceive that their interests are properly represented in political institutions and consider government not wasteful but helpful, their willingness to vote for higher levels of taxation and comply with their tax obligations will increase.

(Bird et al., p. 16.)

The performance of the VAT in any country is influenced by a country’s political institutions (Bird & Gendron, 2007). Political institutions are central in determining the structure of the VAT when adopted (Eccleston, 2007; James, 2015) and without political will this structure is unlikely to change (Ebrill et al., 2001; Crawford, Keen & Smith, 2010). These institutions most likely also influence compliance to the VAT; it seems reasonable to expect people to be more willing to pay taxes to governments that are less corrupt, more effective and fairly elected.

In a cross section of 42 countries, de Mello (2009) finds that government effectiveness, regulatory quality and rule of law are statistically significant determinants of C-efficiency. Aizenman and Jinjark (2008), with the use of a panel dataset of 44 countries over the period 1970-99, show that the durability of the political regime as well as regulation of political participation are statistically significant determinants of C-efficiency. Governments’ ability to control corruption was also shown to be correlated with C-efficiency by McCarten (2006).

I therefore consider political institutions as a potential VAT capacity factor and use data from the World Bank’s Worldwide Governance Indicators to construct an index named Institutions.⁸ Six measures based on the perceptions of a large number of enterprises, citizens and expert survey respondents are included in the index and described in Table 2. Table 3 show the summary statistics of the index.

⁸ The variables in the index showed a high degree of multicollinearity and are therefore not individually included in the models estimated. The index was constructed by ranking countries for each variable in the index and taking the average rank over all variables for each country.

Table 2: Institutions Index Variables

Variable	Description
Political stability and absence of violence	Perceptions of the likelihood of political instability and/or politically motivated violence, including terrorism.
Control for corruption	Perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as 'capture' of the state by elites and private interests.
Regulatory quality	Perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.
Government effectiveness	Perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.
Rule of law	Perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.
Voice and accountability	Perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.

Source: Kaufmann, Kraay and Mastruzzi (2011)

Table 3: Summary Statistics of Institutions

Variable	N	Mean	Std Dev.	Min	Max
Institutions	1187	6.05	3.273	0.06	11.975

2.2.2 Development

Wagner's law is well known; the size of a government is expected to expand as a country becomes more developed. It can be expected that public expenditure on defence, law and order will increase and government will take on additional functions such as the provision of education and welfare services (Peacock & Scott, 2000). This means that as the level of development of a country rises, the demand for additional tax revenue would increase. It is not only in this sense that development could influence VAT performance. Development is associated with higher levels of education, literacy and technology, all of which can be expected to raise the capacity of a country to administer taxes.

I therefore consider the level of development as a VAT capacity factor, measured as GDP per capita. Data for this variable were obtained from the World Bank's World Development Indicators dataset and this variable is summarised in Table 4.

Table 4: Summary Statistics of GDP per Capita

Variable	N	Mean	Std Dev.	Min	Max
GDP per capita	1187	15006	19798.563	161.877	116612.9

2.2.3 Trade openness

It is standard policy advice following trade liberalisation to increase indirect taxes, especially the VAT, in order to replace lost trade revenues (Keen & Ligthart, 2002). Also, collecting VAT on imports is easier than through the self-assessment system tied to domestic VAT collections (Baunsgaard & Keen, 2010). Trade openness has also been shown to significantly influence development (Sachs et al., 1995; Dollar & Kraay, 2004) and government size (Alesina & Wacziarg, 1997). Both, as discussed above, can be expected to influence VAT performance.

I therefore include openness (summarised in Table 5) as a VAT capacity factor, using the standard measure of exports plus imports to GDP with data obtained from the World Bank's World Development Indicators dataset.

Table 5: Summary Statistics of Openness

Variable	N	Mean	Std Dev.	Min	Max
Openness	1187	.920	.524	.221	4.396

2.2.4 Hard-to-tax supplies

Traditionally tax effort studies have identified 'easy-to-tax' sectors as tax handles expected to increase tax capacity. In the VAT literature, the focus is predominantly not on easy-to-tax sectors, but rather on hard-to-tax supplies. The predominant hard-to-tax supplies that can be expected to influence VAT performance are financial services and agriculture. Although the supply of residential accommodation is hard to tax, the revenues received on the exempt supply of residential immovable property serve as a fairly accurate proxy for the total value of the accommodation service and should therefore not have a significant influence on VAT performance (Cnossen, 2011).⁹ In this section I discuss the inclusion of financial services and agriculture as VAT capacity factors.

Financial services, which include deposits, lending, issuance of financial securities, long-term insurance, brokerage, advisory services and many other services are 'the major remaining frontier for the value added tax' (Gendron, 2008, p. 494). Some methods such as the addition method applied in Israel, France and Denmark or the subtraction method provide a fairly accurate proxy for the value of intermediation services, but cannot be applied on a transaction-by-transaction basis. This means that these methods are not conceptually correct, since the VAT is a transaction tax. Also, no

⁹ If the value of the property increases to levels above the interest rate, the margin is not taxed.

deduction of input VAT would be available to businesses to whom financial services are supplied under these methods, resulting in tax cascading.

The cash-flow approach proposed by Poddar and English (1997) allows for the correct calculation of value added by intermediation services and the taxation of this value on a transaction-by-transaction basis. There appear to be two main reasons for the non-adoption of this approach: (1) the administrative complexities of this approach are large, and (2) there is a concern of a loss in tax revenue as a result of implementing this approach (de la Feria & Lockwood, 2010).

The New Zealand approach of zero rating business-to-business core financial services¹⁰ is not a method to tax financial intermediation, but is rather used to remove the negative effects of the exemption of these services. Although this method can be preferred to the exemption when only considering the efficiency of the VAT,¹¹ the potential loss in revenue when compared to the exemption decreases the attractiveness of this option.

Since identifying and separating the intermediation charge from the full margin of financial services efficiently and practically remains problematic, in most instances it is advised to exempt non-fee based financial services from the VAT (Ebrill et al., 2001). This exemption will influence VAT performance since the value added by intermediation services is not directly taxed. Also, the relative importance of financial services in the economy would be indicative of the sectoral composition of the economy; a general tax capacity factor. I therefore include Financial Credit to GDP (summarised in Table 6) in the models estimated as a proxy for the value of financial intermediation services supplied in the economy with use of data from the World Bank's World Development Indicators dataset.

Table 6: Summary Statistics of Financial Credit to GDP

Variable	N	Mean	Std Dev.	Min	Max
Financial credit to GDP	1187	129.14	68.341	15.4	430.33

Under best VAT practice, agriculture should not be taxed any differently to other standard rated supplies of goods and services (Cnossen, 2018). In countries where collection from and administration of rural farmers provide a challenge, efficiency concerns may provide an argument for non-standard treatment of agriculture. This argument is, however, unlikely to hold in most countries.

Political considerations, together with distributional concerns, have however led to a non-standard treatment in the form of exemptions, reduced rates or zero rates applied to agriculture inputs and outputs under most VATs. Although strong arguments have been made against this treatment of the agricultural sector,¹² this sector continues to avoid full taxation under the VAT. Agriculture is also often included in tax effort studies to proxy for the sectoral composition of the economy. I therefore include Agriculture to

¹⁰ Supplies of financial services to consumers remain exempt under this approach.

¹¹ This approach relieves the obligation of financial institutions to apportion their input VAT and further decreases economic distortions by removing the cascading tax. It is of course required of financial institutions to differentiate between businesses and consumers.

¹² Refer to Cnossen (2018) for an in-depth discussion on these arguments.

GDP (summarised in Table 7) as a VAT capacity factor with the use of data from the World Bank's World Development Indicators dataset.

Table 7: Summary Statistics of Agriculture to GDP

Variable	N	Mean	Std Dev.	Min	Max
Agriculture to GDP	1187	10.712	10.695	0.28	55.867

2.2.5 Other capacity factors

In the estimations performed, other capacity factors are also included to test the robustness of the estimates, namely unemployment, population and foreign aid.¹³ Although these variables are not used to predict VAT capacity for purposes of the VAT effort index, justification for the inclusion of these variables is important.

Unemployment is included as a VAT capacity factor since high levels of unemployment may constrain the government's ability to increase taxes, since such an increase could further increase unemployment (Blanchard & Katz, 1996). Population is included since smaller countries tend to have more international trade than larger countries. Similarly, larger countries tend to have more domestic trade than smaller countries (Alesina & Wacziarg, 1998). This is important since the burden of compliance and administration of the VAT is different for international trade compared to domestic trade. Lastly, foreign aid is included since this is likely to influence the need for countries to look towards domestic revenue mobilisation.

One potentially important VAT capacity factor not specifically included in the analysis due to data limitations is the size of the informal sector.¹⁴ The informal sector can only be taxed indirectly under a VAT by taxing the production of informal businesses.¹⁵ This means that the revenue from the value added by informal businesses that should be registered for VAT is forgone. It should, however, be noted that the level of development and the size of the agriculture sector can be viewed as 'broad indicators of informality' (Keen & Lockwood, 2010, p. 143).¹⁶ Further, Friedman et al. (2000) show how political institutions have a statistically significant influence on the size of the informal sector. The influence of the informal sector on VAT performance should therefore be fairly well represented by the inclusion of the level of development, the size of the agricultural sector and political institutions in the models estimated.

3. ESTIMATION AND REGRESSION RESULTS

The VAT is imposed in 161 countries of which 129 are included in the panel dataset.¹⁷ For the analysis I only consider recent VAT performance, from 2004 to 2014. All

¹³ These variables are obtained from the World Bank's World Development Indicators dataset.

¹⁴ For purposes of this article the informal sector can be taken to mean production activities that are not regulated by societal institutions (Castells & Portes, 1989).

¹⁵ These businesses are not registered for VAT and can therefore not claim an input VAT deduction on their inputs.

¹⁶ By using the measurements of informality in Schneider, Buehn and Montenegro (2010), I find a correlation of 0.575 between the size of the agriculture sector and the size of the informal sector.

¹⁷ Refer to Schenk, Thuronyi and Cui (2015) for a list of countries with a VAT. It should also be noted that the number of countries with a VAT depends on what is considered a VAT; different sources therefore have more or fewer countries. A country was only excluded from the sample if sufficient data could not be obtained for the country. The panel is unbalanced.

models are estimated by the two-way fixed effects estimator¹⁸ and I only show country clustered standard errors which are robust to arbitrary heteroscedasticity and autocorrelation. Further, to compare the relative influence of the VAT capacity factors on VAT performance, all variables are standardised. The model estimated, without variables included to test the robustness of the estimates, is written as:

$$VATratio = \beta_1 Inst_{it} + \beta_2 LogGDPpc_{it} + \beta_3 LogOpen_{it} + \beta_4 FcGDP_{it} + \beta_5 AgGDP_{it} + \mu_i + \lambda_t + v_{it} \quad (5)$$

where $i = 1, \dots, N$; $t = 1, \dots, T$; $Inst$ = Institutions; $GDPpc$ = GDP per capita; $Open$ = Openness; $FcGDP$ = Financial credit to GDP; $AgGDP$ = Agriculture to GDP; μ_i = unobservable country effects; λ_t = unobservable year effects and v_{it} = the remainder error term. Following the estimation of (3), I add unemployment, the natural log of population, and foreign aid to GDP interchangeably to give an indication of the robustness of the estimates of (3). The results of these estimations are provided in Table 8.

Table 8: Regression of the VAT Ratio (Equation 2) on VAT Capacity Factors

VAT ratio	(1)	(2)	(3)	(4)
Institutions	0.269** (0.106)	0.269** (0.116)	0.276** (0.110)	0.252** (0.111)
Log GDP per capita	0.582*** (0.199)	0.431* (0.222)	0.573*** (0.205)	0.596*** (0.203)
Log openness	0.332*** (0.0770)	0.341*** (0.0761)	0.333*** (0.0771)	0.351*** (0.0760)
Financial credit to GDP	0.0858* (0.0459)	0.0895* (0.0456)	0.0868* (0.0465)	0.0882* (0.0467)
Agriculture to GDP	0.0168 (0.0941)	-0.0345 (0.0959)	0.0147 (0.0951)	0.0189 (0.0958)
Unemployment		-0.0738* (0.0377)		
Log population		0.176 (0.937)	0.276 (0.929)	0.363 (0.927)
Aid to GDP				0.0317 (0.0329)
Observations	1,187	1,148	1,187	1,180
R-squared	0.944	0.946	0.944	0.945
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

Notes: Country clustered standard errors in parenthesis. *** p<0.01, ** p<0.05, * p<0.1. All variables have been standardised.

The results in Table 8 show that all statistically significant coefficients enter with the expected sign. As institutional quality, the level of development and openness increased,

¹⁸ The null hypothesis of the Hausman test was rejected, meaning the random effects estimator would provide inconsistent estimates.

VAT performance also increased. The positive sign of financial credit to GDP supports de la Feria and Lockwood's (2010) hypothesis that VAT revenue could decline by removing the exemption applicable to financial services. The negative sign of unemployment is also consistent with the hypothesis that high unemployment limits the potential to increase VAT effort.¹⁹

It can also be seen, with reference to the magnitude of the coefficients, that the level of development is the most influential VAT capacity factor, followed by the level of international trade and the quality of institutions. A one standard deviation increase in the level of development, the level of international trade and the quality of institutions is associated with a 1.77%, 1.01% and 0.82% increase in the VAT ratio, respectively. These results should however be interpreted with care; all three of these coefficients most likely suffer from omitted variable bias and simultaneity or reverse causality bias.²⁰ No causal arguments can therefore be made and such arguments are also not the objective of this article.

To determine the extent to which VAT capacity factors explain the variance in the VAT ratio, the R-squared statistic is of importance. As is evident from Table 8, 94% of the variance in the VAT ratio can be explained by the inclusion of the VAT capacity factors as per model (3) above. This means that the model predicts the VAT capacity of a country well, which is important when calculating the VAT effort indexes.

4. VAT EFFORT

VAT effort can be defined as the extent to which a government raises revenues from the VAT, taking into account its capacity to do so. This means that to calculate the VAT effort of a country, the VAT capacity of a country should first be determined. As previously indicated, the major capacity factor for any VAT is the level of consumption in the economy; the base of the VAT.²¹ For this reason VAT performance is measured in this article as the amount of VAT revenue collected as a percentage of total final consumption, referred to as the VAT ratio.

Although consumption is the major capacity factor of the VAT, it is not the only capacity factor. This is perhaps the major weakness of other measures of VAT performance, such as C-efficiency, for cross-country comparative purposes. No two countries are the same. Besides having different levels of consumption, countries differ by institutional quality, their level of development and the advantages in tax administration associated with development. Countries' trade policies, population size, location and other factors that influence the level of international trade also differ. Countries further have hard-to-tax sectors that differ in size, such as the financial, agricultural and informal sectors.

Taking such VAT capacity constraints into account provides for an improved measure of VAT capacity. I report the average VAT capacity for 129 countries over 11 years in Table 9, as predicted by the regression of VAT ratio on a selection of VAT capacity

¹⁹ The results also appear robust to the inclusion and exclusion of additional variables.

²⁰ The structure and rate of the VAT can be expected to influence the level of development of a country since tax revenues are used towards development. Similarly, the compliance costs involved in exporting goods and the payment of refunds will most likely influence international trade. Moore (2007) also shows that taxation affects the quality of governance.

²¹ In practice, VATs often tax production by exempting the supply of certain goods and services.

factors. The VAT capacity index is ranked from the country with the highest capacity to the country with the lowest capacity. The VAT capacity index indicates the percentage of total consumption expenditure that can be taxed, taking into account the economic and political institutional environments of each country. This measure does not take into account the current rate and base applied in each country. The capacity factors included are political institutions, the level of development, trade openness, the size of the financial services and agriculture sectors, population size, and country and year fixed effects (model (3) in Table 8).²²

As expected, more developed countries with higher quality institutions and greater trade openness have a higher VAT capacity than lesser developed countries with poorer institutions and less international trade. Luxembourg, for instance, with the highest VAT capacity of 20 (meaning the VAT ratio at capacity is predicted at 20%), trades internationally nearly four times as much as it produces locally, ranks among the most developed countries, and has institutional quality that ranks very high.²³ Luxembourg also has a large financial services sector and a very small agricultural sector. In short, Luxembourg is probably close to the ideal environment for the VAT to operate in, when considering revenue performance.

At the bottom of the index is Burundi, an East African country with the second lowest level of development in the world. About 90% of the population are subsistent farmers (Agriculturist, 2017) whose self-supplies are not included within the scope of a VAT. With only about 5% of the population having access to electricity (USAID, 2017), VAT administration challenges are bound to be excessive. It is admittedly an extreme example, but it does not seem sensible to compare countries such as Luxembourg and Burundi by only referring to the amount of their consumption that is taxed.

Table 9: Index of VAT Capacity (VC)

Country	VC	Country	VC	Country	VC
Luxembourg	20	Croatia	13.2	Brazil	9.92
Singapore	18.69	Poland	13.19	Armenia	9.91
Ireland	17.75	Equatorial Guinea	13.14	China	9.9
Netherlands	17.28	Dominica	12.78	Argentina	9.87
Switzerland	17.23	Bulgaria	12.75	Peru	9.85
Denmark	16.87	St Vin. and Gren.	12.71	Philippines	9.8
Belgium	16.77	Botswana	12.68	Nicaragua	9.61
Iceland	16.45	Costa Rica	12.66	Colombia	9.59
Malta	16.36	Thailand	12.53	Ghana	9.55
Sweden	16.23	Grenada	12.45	Ecuador	9.53
Austria	16.21	Lebanon	12.32	Kyrgyzstan	9.53
Norway	16.16	Jordan	12.31	Guatemala	9.48
Cyprus	16.04	Namibia	12.12	Sri Lanka	9.48
Finland	15.91	Uruguay	12.12	Bolivia	9.38
Germany	15.48	South Africa	11.95	Cambodia	9.2

²² I do not include the other capacity factors as per the second to fourth regression results since these factors did not substantially improve the explained variance in VAT ratio and also to keep the sample size as large as possible.

²³ The statements in this section are based on the data used for the estimations performed in this article, unless indicated otherwise.

Country	VC	Country	VC	Country	VC
Canada	15.43	Romania	11.9	Egypt	9.16
Slovenia	15.23	Fiji	11.88	Indonesia	9.09
Slovakia	15.06	Cape Verde	11.78	Senegal	8.93
United Kingdom	14.94	Jamaica	11.68	Cote d'Ivoire	8.78
Czech Rep.	14.93	Samoa	11.68	Mozambique	8.72
New Zealand	14.87	Tunisia	11.65	India	8.43
Hungary	14.81	Macedonia	11.58	Zambia	8.29
Estonia	14.76	Belarus	11.57	Togo	8.1
Seychelles	14.62	Serbia	11.51	Benin	7.93
France	14.52	Mexico	11.32	Kenya	7.86
Korea, Rep.	14.47	Turkey	11.31	Nigeria	7.86
Australia	14.4	Kazakhstan	11.3	Tajikistan	7.86
Barbados	14.36	Mongolia	11.13	Mali	7.82
Portugal	14.32	Albania	10.93	Sierra Leone	7.8
Lithuania	14.31	Georgia	10.86	Tanzania	7.74
Malaysia	14.28	Ukraine	10.71	Madagascar	7.72
Spain	14.22	Azerbaijan	10.67	Malawi	7.56
Israel	13.97	El Salvador	10.67	Cameroon	7.34
Japan	13.97	Vietnam	10.66	Burkina Faso	7.22
Latvia	13.87	Lesotho	10.53	Nepal	6.97
St Kitts and Nevis	13.82	Moldova	10.53	Uganda	6.82
Italy	13.81	Honduras	10.52	Bangladesh	6.54
Mauritius	13.71	Morocco	10.49	Pakistan	6.44
Panama	13.64	Paraguay	10.37	Ethiopia	6.37
Greece	13.4	Dominican Rep.	10.31	Niger	6.07
Trin. and Tobago	13.36	Russia	10.29	Congo, DR	5.76
Chile	13.35	Venezuela	9.95	Cen. African Rep.	5.61
St Lucia	13.33	Algeria	9.93	Burundi	5.49

Following the prediction of total VAT capacity, calculating countries' VAT effort is straightforward. The VAT effort is calculated as:

$$VATeffort = \frac{VATratio}{VATcapacity} \quad (6)$$

Equation 6 shows that VAT effort is equal to the current percentage of total consumption expenditure that is taxed, divided by the percentage of total consumption expenditure that can be taxed (based on the results in Table 9). I provide the VAT effort index, together with an effort rank, alphabetically for all countries in the sample in Table 10.

Continuing with the example of Luxembourg and Burundi, Table 10 shows that Luxembourg has a VAT effort of 0.65. In 2014 (the last year in the data period), Luxembourg had a standard VAT rate of 15% and reduced rates of 12% and 6%. Luxembourg also had the fifth highest VAT ratio in the dataset and a C-efficiency exceeding 1 in 2014.²⁴ Yet, Luxembourg had capacity to increase revenues from the

²⁴ The C-efficiency is based on my own calculations with data used to calculate the VAT ratio used in this study.

VAT, which partially explains the increase in the VAT rates to 17%, 14% and 8% on 1 January 2015.

On the other hand, the VAT effort of Burundi is 0.95, the 12th highest in the sample. Burundi has a VAT rate of 18% with a reduced rate of 10%. Although Burundi's VAT is not a modern VAT, it also does not suffer from excessive exemptions, with a shorter list of exemptions than most European countries.²⁵ Although Burundi had a VAT ratio of about 5% and a C-efficiency of 0.28 in 2014, when considering its VAT effort, Burundi is not doing as poorly as these two figures suggest. The high VAT effort in Burundi also means that there is likely limited capacity to obtain further revenues from the VAT.

It can further be seen from the VAT effort index that some countries have a VAT effort exceeding 1. This may indicate an overreliance on revenues from the VAT. For instance, Belarus has a VAT effort of 1.13 and a VAT rate of 20%. With a personal income tax rate of only 13%, a corporate tax rate of 18% and no capital gains tax (World Bank, 2017a), it may be challenging for Belarus to ensure equity in the tax system.

As a final point, it should be understood that the VAT effort index is not useful in comparing policy or compliance gaps; this requires an alternative method by decomposing C-efficiency (refer to Keen, 2013). The main purpose of the index is to compare VAT performance among countries based on a comparable measure of VAT capacity and identify the potential of a country to increase their VAT effort.

Table 10: Index of VAT Effort (VE)

Country	Rank	VE	Country	Rank	VE
Albania	17	0.9	Latvia	69	0.64
Algeria	48	0.73	Lebanon	112	0.41
Argentina	30	0.8	Lesotho	99	0.53
Armenia	25	0.84	Lithuania	63	0.65
Australia	115	0.34	Luxembourg	64	0.65
Austria	66	0.64	Macedonia	35	0.79
Azerbaijan	11	0.95	Madagascar	124	0.23
Bangladesh	97	0.54	Malawi	91	0.56
Barbados	53	0.7	Malaysia	128	0.13
Belarus	3	1.13	Mali	40	0.77
Belgium	92	0.55	Malta	86	0.58
Benin	15	0.91	Mauritius	87	0.58
Bolivia	9	0.97	Mexico	113	0.4
Botswana	90	0.56	Moldova	4	1.06
Brazil	6	1	Mongolia	23	0.87
Bulgaria	19	0.89	Morocco	13	0.95
Burkina Faso	20	0.89	Mozambique	21	0.88
Burundi	12	0.95	Namibia	78	0.6
Cambodia	107	0.45	Nepal	45	0.75
Cameroon	31	0.8	Netherlands	95	0.55
Canada	119	0.29	New Zealand	36	0.79
Cape Verde	44	0.75	Nicaragua	70	0.63

²⁵ According to the Burundi VAT Act, financial services, residential accommodation, medical goods and services, education, agricultural inputs and postage stamps are exempted.

Country	Rank	VE	Country	Rank	VE
Central African Rep.	108	0.44	Niger	114	0.39
Chile	32	0.8	Nigeria	129	0.03
China	1	1.27	Norway	41	0.77
Colombia	54	0.7	Pakistan	61	0.66
Congo, DR.	123	0.23	Panama	117	0.31
Costa Rica	103	0.5	Paraguay	55	0.7
Cote d'Ivoire	127	0.2	Peru	22	0.88
Croatia	2	1.14	Philippines	122	0.24
Cyprus	67	0.64	Poland	51	0.71
Czech Rep.	68	0.64	Portugal	65	0.65
Denmark	37	0.77	Romania	29	0.81
Dominica	57	0.69	Russia	34	0.8
Dominican Rep.	106	0.48	Samoa	75	0.61
Ecuador	50	0.71	Senegal	18	0.9
Egypt	110	0.43	Serbia	10	0.96
El Salvador	71	0.62	Seychelles	16	0.91
Equatorial Guinea	126	0.21	Sierra Leone	116	0.34
Estonia	33	0.8	Singapore	120	0.26
Ethiopia	125	0.22	Slovakia	79	0.6
Fiji	26	0.84	Slovenia	47	0.74
Finland	49	0.72	South Africa	56	0.7
France	74	0.61	Spain	102	0.52
Georgia	5	1.02	Sri Lanka	100	0.53
Germany	82	0.58	St Kitts and Nevis	80	0.59
Ghana	93	0.55	St Lucia	42	0.77
Greece	83	0.58	St Vinc. and Gren.	101	0.53
Grenada	94	0.55	Sweden	43	0.76
Guatemala	84	0.58	Switzerland	118	0.31
Honduras	88	0.57	Tajikistan	24	0.85
Hungary	38	0.77	Tanzania	96	0.55
Iceland	58	0.69	Thailand	109	0.44
India	62	0.65	Togo	27	0.84
Indonesia	77	0.6	Trin. and Tobago	105	0.49
Ireland	85	0.58	Tunisia	60	0.68
Israel	59	0.68	Turkey	81	0.59
Italy	98	0.53	Uganda	76	0.61
Jamaica	72	0.62	Ukraine	7	1
Japan	121	0.25	United Kingdom	104	0.5
Jordan	28	0.82	Uruguay	8	0.99
Kazakhstan	89	0.57	Venezuela	14	0.93
Kenya	73	0.62	Vietnam	46	0.75
Korea, Rep.	111	0.43	Zambia	52	0.71
Kyrgyzstan	39	0.77			

5. CONCLUSION

The VAT is a major source of tax revenue in nearly all of the countries where it is applied.²⁶ Due to the relative ease of shifting production and incomes to low-tax jurisdictions, obtaining revenue from consumption taxes may become of even greater importance. Once established that additional revenue from a VAT is required, it should be considered whether a country has the necessary capacity to increase the VAT rate or broaden the base of its VAT. The VAT effort index provided in this article indicates the extent to which countries can look towards the VAT as a source of additional revenues.

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²⁶ Based on data from the World Bank (2017b), Afghanistan, Angola, and Nigeria are countries where VAT revenues would likely not be regarded as a major source of tax revenues.

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