Tax transition in developing countries : Do value added tax and excises really work ?

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Abstract

This paper investigates the role of Value Added Tax (VAT) and excises as first wave tax transition tools in developing countries. Focusing on a sample of 96 developing countries over the period 1985-2013, we investigate whether the adoption of VAT enable developing countries to increase the likelihood of succeeding tax transition. Results indicate that having a VAT, allow developing countries to increase the probability of succeeding tax transition by near 10%. We further investigate the extent to which VAT and excises offset trade tax revenue losses of trade liberalization in these countries. Our estimates reveal that VAT is offsetting by 67% trade tax revenue losses in developing countries with an U relationship, while this effect holds for excises duties with an U inverted relationship. The study also points out heterogeneities (while VAT tax transition effect is robust to African and Asian countries, it seems not for Latin American countries), as well as asymmetries (the revenue collection of VAT and excises didn't increase the period over which developing countries face an increase in trade tax). Overall, the study concludes that, first wave tax transition even strengthened by these instruments, seems not irreversible. It suggests to take with closer attention VAT and excises as powerful first wave tax transition tools in developing countries.

Keywords : Tax transition, VAT, Excises, Developing countries.

1 Introduction

The power to tax is a major concern in developing countries, where the ability to raise revenue remains challenging. Stylized facts bring out that, developing countries do recover only about 15-20 percentage points of their GDP in tax revenues, whereas this average is about 40 percentage points of GDP in developed countries (Besley & Persson, 2014). Following the United Nations Financing for Development Conference (Addis Ababa, 2015) the role of taxation is to be re-legitimized in developing countries, considering the volatility of foreign development assistance, and in order to reach millennium development goals. As pointed out by Brautigam et al. (2008) tax revenues are the first and most predictable development finance that enable countries to achieve sustainable tax space and ensure the provision of public goods.

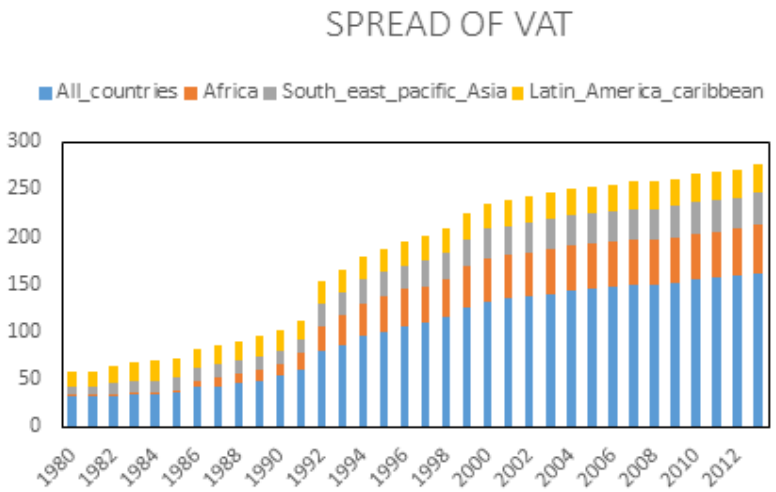
Yet, in developing countries, before trade liberalization, international trade taxes accounted for the most of tax revenues of these countries, allowing them to finance public expenditures (Tanzi & Zee, 2000). Due to trade openness policies, these countries like developed countries, face a sharp fall in their trade tax revenues. A number of empirical studies bring out the negative effect of trade liberalization on trade tax revenues in developing countries (Bevan, 1995; Khattry & Rao, 2002; Keen & Ligthart, 2002; Keen & Simone, 2004). While developing countries made substantial progress towards more open trade regimes in the context of World Bank and World Trade Organization policies guidelines (Jones et al., 2011), the major problem of the tax consequences of their trade liberalization remains to offset revenue losses related to tariff disarmament. Over the past three decades, these countries strengthened their domestic tax revenues through a tax transition process (Chambas, 2005a). Tax transition consists in a move from public revenues, long dominated by international trade taxes, to public revenues levied on domestic inside activities.

The preference for a value added tax (VAT) as a tax transition tool, or as a first wave tax transition tool, is strongly motivated by the fact that, VAT concerns a broad tax base, that can spread tax burden throughout the economy. VAT is also neutral, and can be implemented with ease in many developing countries (Chambas, 2005b; Bird & Gendron, 2007). It doesn't affect the competitiveness of exports, as exports are taxed with zero-rate, and exporters can enjoy the right of VAT refunds, from VAT charged on their inputs[1]. It doesn't increase local producers' costs since they can also deduct VAT on their intermediate inputs. Thus, tax transition reforms initiated in developing countries during the 1980s and the 1990s had the common leitmotiv of more adoption of VAT (Bird, 1989 ; Bird & Gendron, 2007) recognizing resource mobilization constraints on direct taxes of these countries (Chambas, 2005b). Excise duties, levied at high rates on specific goods such as alcohol, tobacco and cigarettes, can also provide significant revenues, most time due to the inelasticity of consumer price to these goods (Bolnick & Haughton,

[1]For a review of VAT mechanisms see (Ebrill 2001) :The modern VAT (International Monetary Fund)

1998 ; Cnossen, 2011). While an average of 30 countries had VAT in their tax legislation during the 1980s, this number has significantly increased to 120 in the 2000s and to 150 in 2013 (Ufier, 2014).

Graph 1 : The spread of VAT adoption in developing countries.



Source : Author with IMF data

But an efficient VAT, as highlighted by (Ebrill, 2001) implies a single VAT rate on a broad tax base without exemptions, and a high level of tax compliance. Its management requires a wider tax practices, and efficiency in the VAT refund mechanisms, the important factor underlying the neutrality of this tax (Bodin, 2012). Thus, if it seems theoretically easy to reinforce indirect taxes like VAT and excises, to compensate for revenue losses on international trade, numerous VAT exemptions, reduced VAT rates, and poor operation of VAT refunds implemented in almost developing countries, undermines VAT revenue performance, and alter tax transition process (Chambas, 2005b).

Based on these claims, the aim of this paper is to provide an empirical investigation related to VAT and excises as first wave tax transition tools in developing countries. Surprisingly, as important as the question seems, there are currently no empirical studies that investigate this relationship[2]. This paper aims to deal with this empirical gap through two empirical investigations. First, it investigates whether, the adoption of VAT enables developing countries to increase the likelihood of succeeding tax transition. To the extent that having a VAT, enable countries to reach tax transition purposes, the second empirical investigation is to quantify the degree to which VAT and excises are offsetting trade tax revenue losses in developing countries.

[2]Ebeke et al. (2016) analyzed the effects of having VAT on tax revenue performance in developing countries, but not on tax transition process. Combes et al. (2009) investigated the effects of foreign development assistance on tax transition in developing countries. Diarra, (2012) investigated the effects of commodity price shocks on tax transition in West African Economic and Monetary Union countries

The rest of the paper is organized as follows : Section 2 refines the concept of tax transition and proposes our measure of tax transition, while section 3 presents stylized facts related to the phenomenon. Section 4 focuses on VAT and excises as tax transition tools. In section 5 we emphasize with the empirical framework followed by results in section 6. Then, we deal in section 7 with robustness checks and conclude the paper in its last part.

2. Sound concept and attempts of measuring tax transition.

2.1 Concept of tax transition.

Tax transition is a concept that cover a multidemensional area of meaning. Yet, in the weak hypothesis, it refers to the balancing role of international trade taxes through increases in domestic inside revenue. This substitution effect can occur through indirect taxes (VAT and excises) or through direct taxes (corporate and income taxes). Because of the particular revenue raising power of VAT and excises, it is more convenient that a country undertakes first generation tax transition features with these instruments. On the stronger hypothesis, tax transition consists in reducing the social cost of public revenue through a best composition of tax, while maintaining an appropriate level of tax revenue. This last assumption implies that, a tax transition criteria can be derived from the evolution of tax revenue around a certain threshold of revenue that can be determined endogenously. Besides, tax authorities have to reduce the revenue contribution of distortionary taxes such as custom and export duties, and enhance the stability of public revenue by reinforcing the relative contribution of stable and predictable taxes such as VAT. In the case of mining countries, tax transition views would add an additional condition to reduce the contribution of mining taxation as compared to non-mining taxation, thereby reducing the volatile component of government revenue.

2.2 Attempts of measuring the concept.

2.2.1 Initial attempts of measuring the concept.

Measuring tax transition is a daunting task even if by definition transition cover a qualitative dimension. One feature is to measure tax transition directly by VAT. The underlined idea is that, VAT is a more stabilizing tax and represents a more predictable source of government revenue. Even though empirical studies of Ebeke and Ehrhart (2010); Ebeke and Ehrhart (2011) confirm the stabilizing effect of VAT, a quantitative manner of measuring the concept is not suitable because transition better cover a qualitative meaning. In the West African Economic and Monetary Union (WAEMU), a tax transition criteria implies that the ratio of domestic tax revenue to international trade tax revenue need to be higher than 1.2, and that, tax revenue to GDP should converge to a value of 17 percentage points of GDP. But these thresholds in WAEMU countries can not be apply to all countries. Second, they also lack robust basis and

finally, doesn't take into account tax potential of each specific country.

Nevertheless, our definition of transition broadly implies a change in the composition of government revenue and a norm of tax revenue. For example it not appropriate to consider a country succeeding tax transition if it better changes the composition of its tax revenue without maintaining an adequate level of overall tax revenue, or conversely if it reaches an adequate level of revenue without a sufficient change in the composition of its tax revenue. To overcome these difficulties, Attila et al. (2011) suggest to take these conditions simultaneously into account and to retain an endogenous norm of public revenue that is determined by a country's tax potential.

2.2.2 How is tax transition finally computed?

We compute tax transition following Attila et al. (2011). Basically, these authors suggest that a country is meeting tax transition, if the following conditions are simultaneously satisfied :

Condition 1: norm of tax revenue.

According to this condition, country's total tax revenue should represent at least 90 percent of its tax potential [3]. This condition is derived from the fact that, we can not suppose a country, succeeding its transition process, if it doesn't perform tax effort over the interested period.

Condition 2: change in the composition of government revenue.

Assumption 1: condition on trade tax

The ratio of trade tax revenue to GDP, must decrease over a period of five years. We compute the growth rate of trade taxes over this period. Diarra (2012) amended this condition to three years, to release the transition conditions. By doing this, he puts a strong hypothesis on trade tax revenues which is the decrease of this tax quickly over a period of three years. By the fact that trade tax revenue may not necessarily decrease over a reduced period of three years, we enable a mid-term period of five years as pointed out by Attila et al. (2011).

Assumption 2: condition on domestic tax revenue.

Domestic tax revenue must increase over a period of five years. We compute the growth rate of domestic tax revenue over each five years period. If these three conditions are met, we assume that, the country is meeting tax transition otherwise, fails to meet tax transition. To obtain a year by year tax transition, we improve Attila et al. (2011) by a backward process computation. Thus, a country is meeting tax transition one year, if five years before that year, all these conditions are met.

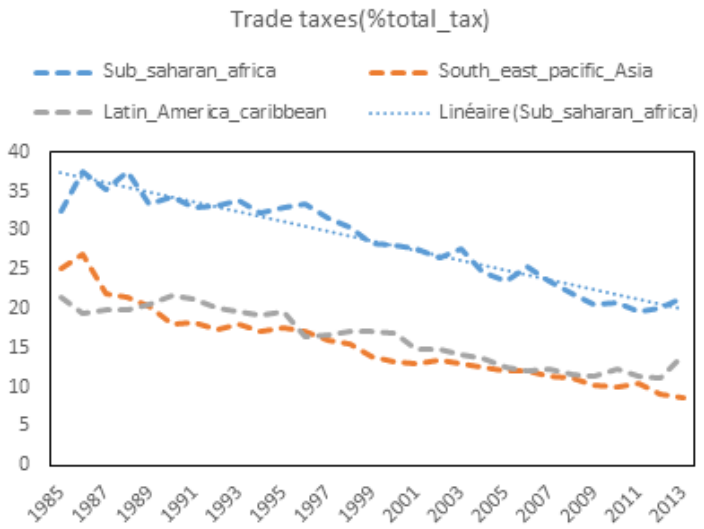
[3]The detail of computing tax potential is given in appendix

3.Tax transition in developing countries: stylized facts.

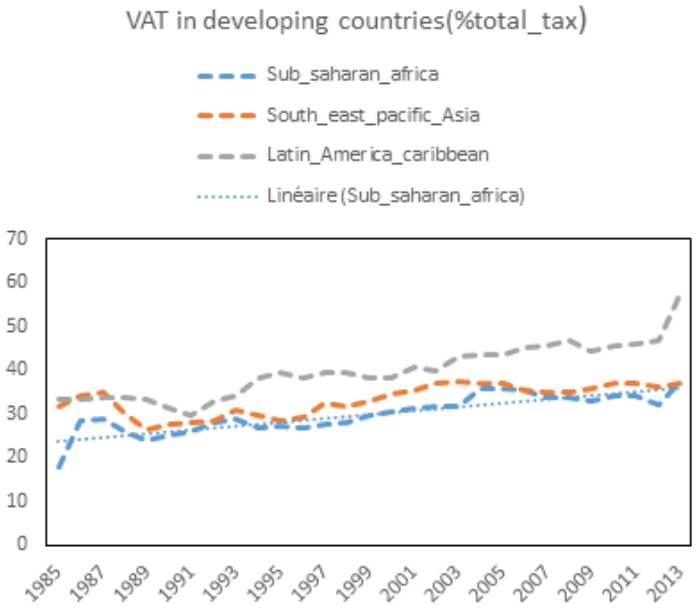
3.1 VAT, trade taxes and excises : recent trends.

Despite the centrality of the question, it remains tricky to find in the literature, studies that confront data with the view to analyze tax transition. This section provides some basic graphs, in order to look at recent trends in VAT, excises, and trade tax revenues in developing countries, to shed light on the phenomenon. What does data show ?

Graph2 : Trade taxes, VAT and excises : recent trends



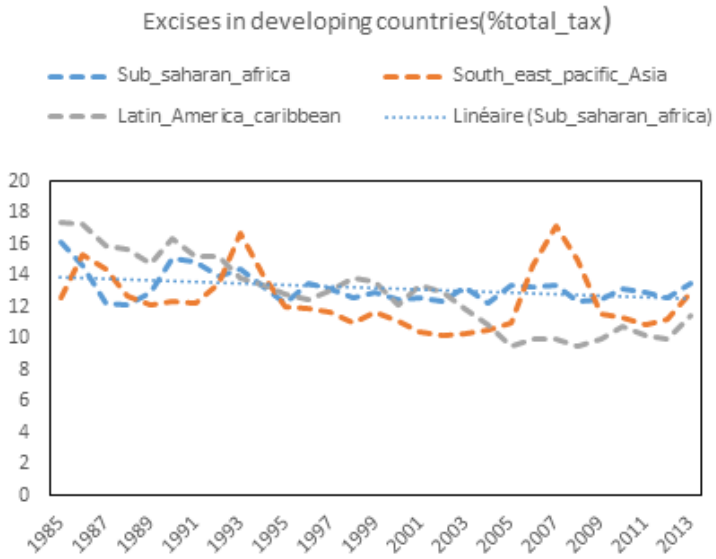
Source : Author with ICTD data.



Source : Author with ICTD data.

As it can be observed above, graph 2 shows a transition process occuring by VAT (under the weak hypothesis). On the whole, we notice that, taxes on international trade decreased over the entire period, whatever the region considered. Sub-Saharan African countries, the most dependent on custom duties, face a sharp fall in their trade tax revenues as compared to other countries. While

the effects of trade liberalization on trade tax revenues may depend on the elasticity of imports to tariffs, graph 2 might tell us that, the negative effect of trade liberalization outweighs the positive effect of increases in tax base. Turning to the same graph, we observe an increase in VAT revenue, telling us a transition process occuring by VAT. Latin America and Caribbean countries have the greatest increase in VAT revenues. This doesn't necessarily mean that, they are performing well with tax transition (under the stronger one). Indeed, it can tell that, they could offset significantly their revenues losses with VAT (weak hypothesis) and next, we must take into account their tax efforts over the interested period. Even if VAT revenue is growing in developing countries, in comparative terms, African countries are those with the lowest VAT revenue, but whose trend is outstanding over the period.



Source : Author with ICTD data.

Excises duties remained quietly unchanged over the period, with a steady trend, but can reach significant percentage points of tax revenue over selected years. Its contribution to tax transition is not to be neglected (Cnossen, 2011) since it can raise about third of VAT revenue (Chambas, 2005b).

3.2 Is tax transition common in developing countries?

The main purpose of this section is to address the quality of the transition process over developing countries by looking at the joint frequency and the conditional frequency of transition. It seems a way to understand the state of transition over these countries.

Table 1: Joint frequency of transition

Regions\years	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Sub-Saharan Africa	10	11	10	10	12	12	15	15	17	17	18	17	15	17
	27%	29,7%	27%	27%	32,4%	32,4%	40,5%	40,5%	46%	46%	48,6%	46%	40,5%	46%
South East Pacific Asia	11	13	13	10	10	10	10	9	8	8	11	4	5	10
	42,3%	50%	50%	38,4%	38,4%	38,4%	38,4%	34,6%	30,7%	30,7%	42,3%	15,3%	19,2%	38,4%
Latin America and caribbean	6	8	8	12	8	7	8	7	9	9	6	7	7	5
	28,5%	38%	38%	57,1%	38%	33,3%	38%	33,3%	43%	43%	28,5%	33,3%	33,3%	23,8%

Source : Author

*The first number indicates the number of countries in transition that year, the second is the joint frequency.

Table 1 shows that, until the early 2005s, Sub-Saharan African countries were less able to meet tax transition as compared to the rest of developing countries. From the 2006s, the situation is reversed with African countries becoming more in transition than others, such result which can be explained by more adoption of VAT.

Taking a look at 2000s transition performance, Burkina Faso, Uganda, Senegal, Togo, Cameroon, Ghana, Madagascar, Mali, Tanzania and Nigeria were African countries that met tax transition. Indeed, four of the eight West African Economic and Monetary Union countries(WAEMU) reached transition (Burkina Faso, Senegal, Togo and Mali). According to our transition assumptions, they performed tax efforts about 1.4 ; 2.11 ; 0.08 ; 1.32 points of their GDP respectively.

• Senegal

Senegal introduced a single VAT rate at rate 18% in July 2000. Government strengthened tax administration with the introduction of a single taxpayer identification number and a large-taxpayer unit. The unification of VAT rates and strong collection efforts yielded a significant percent increase in tax revenue.

• Burkina Faso

This country introduced a new withholding tax on purchases from wholesalers, allowing better taxation of operations in the informal sector and tight administration of VAT on investment activities to offset revenue losses from full implementation of common external tariff (CET) which declined from 25% to 20%.

• Togo

Country's effort to improve efficiency in tax administration, broadening tax bases, and recovering back taxes, increased revenue around 2 percentage points of GDP. The fiscal policy established under the IMF Staff-Monitored Program is a step which enhanced country revenue performance.

• Mali

Mali's efforts to compensate for revenue losses due to the introduction of the common external tariff have consisted in modernizing indirect tax system in April 1999. Like Senegal country introduced a single VAT rate at 18% and limitation of VAT exempts goods. Tax administration was strengthened. A large enterprise division was fully computerized. Taxpayers compliance had been enhanced by extending the registration system to a sufficient number of taxpayers in 2000.

Table 2: Conditional frequency (transition in year t conditional to transition in t-1

Regions\Years	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Sub Saharan Africa	4	5	5	5	5	7	7	6	7	7	10	10	10
	40%	45,4%	50%	50%	41,6%	58,3%	46,6%	40%	41,1%	41,1%	55,5%	58,8%	66,6%
South East Pacific Asia	6	8	7	6	7	6	8	8	6	6	8	3	4
	54,5%	61,5%	53,8%	60%	70%	60%	80%	88,8%	75%	75%	72,7%	75%	80%
Latin America and Caribbean	4	6	7	10	6	5	7	6	8	8	5	6	6
	66,6%	75%	87,5%	83,3%	75%	71,4%	87,5%	85,7%	88,8%	88,8%	83,3%	85,7%	85,7%

Source: Author

*The first number indicates the number of countries in transition in year t and that have been in transition in t-1. The second number is the conditional frequency.

Table 2 focuses on the conditional probability of tax transition. We aim to look at the state of transition one year, according to transition performance the year before. This shows the persistence of transition over time or the irreversibility of the phenomenon. It indicates that, tax transition is less persistent in Sub-Saharan African countries as compared to other countries. Indeed, in year 2001 only four of the ten African countries that reached transition in 2000, remained in transition in 2001 (Uganda ; Senegal ; Madagascar ; Tanzania). One WAEMU country (Senegal) stills remained in transition with an increased tax effort (2.11 to 2.59).

4.VAT and excises as tax transition tools.

4.1 VAT as a tax transition tool.

VAT is an important tool for revenue mobilization. The success of such an instrument makes VAT an important tax transition tool in almost countries that adopted VAT. This success comes from the combination of two essential qualities: its neutrality, and the fact that VAT finally target consumption, a broad tax base. Compare to turnover tax, there is no cascading effect of VAT, through its inputs-outputs invoice mechanism. The invoice mechanism of VAT reduces the risk of revenue losses compared to turnover tax.

However in practice, these qualities can be lost depending on the design of VAT, its perfect or

imperfect implementation [4], and the legislative and administrative framework of the country that adopted VAT, such as the number of rates, the optimal threshold, and the restrictions to the VAT refund mechanisms (Ebrill, 2001; Bird & Gendron, 2007).

The literature primarily highlights the role of the optimal threshold on VAT revenue performance. Threshold characterizes the trade-off between revenue collection and collection costs. If the threshold is too weak, tax administration is stretched and unable to monitor registered firms. It appears difficult to make audit, which affect VAT performance. On the other hand, if the registration threshold is very high, VAT base becomes narrower (Keen & Mintz, 2004). Thus, considering firms which are below the threshold, they can not charge VAT on their output, and can not enjoy the right of VAT refund mechanisms. These firms would make pressure in the form of lobbying for input exemptions, that go into their businesses. If such lobbying fails, these firms are more likely to deal with other unregistered firms, which would reinforce structural dualism and affect VAT revenue performance by making participation in the formal sector less attractive (Kanbur & Keen, 2014). Because the question of the threshold is an important factor for VAT revenue performance, Keen and Mintz (2004), investigate the optimal threshold of a VAT. Their rule stipulates that, the optimal threshold of a VAT is inversely proportional to firms size and to the social value of public funds, whereas this is proportional to the compliance and administrative costs. They highlight the fact that, labor intensive activities that with higher ratio of value added to sales, should be set to a relatively low threshold.

The importance of designing efficient VAT rate and constrain multiple VAT rates, is also a great concern while addressing VAT revenue performance in tax transition. With multiple VAT rates, it becomes possible for the taxpayer to apply a wrong rate of VAT to the base, even if it is not done fraudulently (Tait, 1991)[5]. Scarce administrative resources have to be channeled into resolving those classification patterns. Compliance costs rise as the tax form becomes complex, and accounting records need to be more complete. The result is that, VAT base becomes narrower (Agha & Haughton, 1996). Multiple VAT rates also exacerbate tax credit patterns. If the input tax rate is multiple and sometimes greater than the output tax rate, there is a danger that, procedures on VAT refunds are loosened and the degree of scrutiny fails (Ebrill, 2001). High average rate also leads to low degree of compliance. Taxpayers who face high tax rate, have greater incentive to evade tax. Tax rate and tax base are not independent instruments. Thus, it is better to introduce low VAT rates on a broad tax base, rather than having high VAT rates (Agha & Haughton, 1996) in the prospect of mobilizing more VAT revenue.

VAT exemptions break VAT chain. If the exemption occurs at the final stage, the result is a

[4] VAT structure is littered with many privileges and exemptions that minimize its revenue impact in developing countries

[5] Tait identifies more argument against multiple VAT rate. For a detail see (Tait, 1991): Value-Added Tax, Administrative and Policy Issues (International Monetary Fund). Occasional paper 88

loss of revenue, since value added at the final stage escapes tax. On the firm's side, exemptions maintain a VAT charge on intermediate goods and lead to a change in the tax burden. The firm no longer charge VAT to the customer and is no longer entitled to be reimbursed the amount of VAT paid on his purchases (Chambas, 2005b). Compare to export firms, there is a negative effective protection of the local firm. While VAT refund mechanism is the "Achilles heel" of VAT system (Harrison & Krelove, 2005), the impossibility for the local firm selling exempt goods to deduct VAT, restores the cascading effects specific to turnover taxes (Chambas, 2005b). On the other side, if exemption occurs at intermediate stage, the cascading effect of tax on inputs is that, as the price charged by downstream firms using the exempt item rises, in order to cover their increased costs, tax on output increases. Thus, value added prior to the exempt stage is effectively taxed more than once (Ebrill, 2001; de La Feria, 2013). With this in mind, VAT loses neutrality if exemptions are not limited. In such circumstances, the substitution effect of VAT to trade taxes in tax transition process, could bring the economy far from an optimum (Emran & Stiglitz, 2005).

Keen (2013), summarizes these findings and addresses the effectiveness of VAT in countries that adopted VAT. Author brings to the literature theoretical tools that help understand factors that weaken VAT revenue performance. Drawing his analysis on the «C efficiency concept» an indicator of the IMF departure of public finance, author shows that, the first of the most important factors that drive VAT revenue performance has by far consisted in changes in «C-efficiency» even if this concept is not independent from tax rate and tax base. «C-efficiency» has often moved in the opposite direction from the standard rate of VAT. The higher is the rate, the lower is «C efficiency». According to the author, understanding the evolution of VAT revenue requires understanding the evolution of «C-efficiency». VAT gaps between countries comes from two factors : a "policy gap" (multiple rates and exemptions), and a "compliance gap" or imperfect implementation of VAT. For developing and emerging economies, compliance gap is the most important factor, that drive VAT revenue gap, while the opposite seems for developed countries. In addition, De Mello (2009) in his study concerning OECD and non-OECD countries shows that, «C-efficiency» ratio increases with low VAT rates. A reasonable support of these studies is that, developing countries those want to succeed tax transition with VAT, must set up a low VAT rates on a broad tax base.

Despite the fact that VAT can lose qualities if imperfectly implemented, it is wise for a country to adopt VAT. In fact, Keen and Lockwood (2006) test the hypothesis of the revenue raising power of VAT (VAT money machine hypothesis) in OECD countries and find out that, countries with VAT do recover more revenue than those without, all else equal. Conducting the same analysis on Sub saharan African countries, Ebeke et al. (2016) investigated whether VAT has led to more revenue collection in Sub-Saharan African countries and found out the same result that,

VAT has a large positive effect on non-resource taxes, and that, this positive effect remains even several years after the adoption of VAT. Thus, even with imperfections, VAT has shown in a number of cases, its revenue raising power in countries that adopted VAT as compared to countries without. But, Keen and Lockwood (2010) show that, these effects are non-linear, and vary across countries, according to their income level, reliance on agriculture, and degree of openness. Further, Ebeke and Ehrhart (2010) show that, VAT reduce the instability of tax revenue for Sub-Saharan African countries and that, the stabilizing effect of VAT has been reinforced since the mid 1990s. In their next paper Ebeke and Ehrhart (2011) found that, this effect is robust to all developing countries that adopted VAT. Nevertheless, Baunsgaard and Keen (2010) provide controverse finding about the effectiveness of VAT. These authors analyzed the effect of trade liberalization on domestic tax revenue. From a panel of developing countries, they found that, high-income countries have compensated for their revenue losses on international trade. For middle-income countries, compensation ratio has been between 45-60 percent of each dollar lost on international trade. However, revenue collection has been extremely low in low-income countries (those most dependent on trade tax revenues). They recovered, at best, not more than 30 percent of every dollar lost on international trade. An important point to make is that, unlike previous literature, they do not find strong evidence that, the presence of a VAT has made it possible to do better, in facing the negative effects of trade liberalization on tax revenue.

4.2 Excises as a complement to VAT.

Excise duties received relatively little attention in the tax literature as compared to VAT. However, taxing specific goods like alcohol, tobacco, oil and beer, is motivated with the ongoing consideration that, there are few substitutes that consumers would find equally satisfactory for these goods, so that consumption remains high despite excises lead to high prices. The inelasticity of consumption to excises, is an important argument to maintain excise taxation, and to raise more revenue. Excises can also help discourage alcohol and tobacco consumption due to the fact that it increases significantly consumption prices (Cnossen, 2005). As Ramsey (1927), pointed out, as long as goods are unrelated in consumption, tax rates should be high on the good with the lowest price elasticity. Thus, excises which can be levied at high rates, can provide complementary revenue to VAT (Bolnick & Haughton, 1998). These arguments are not however, independent from the design of excises and require appropriate design. The literature discusses the question of whether it is wise to design specific[6] or ad valorem excises rate. Specific rates reduce relative price differences between low-priced and high-priced goods, whereas ad valorem rate increases absolute price differences. For tax transition tools, the choice between these two

[6]For more detail see Cnossen et al, (2005). A specific rate is design on a fixed amounts per quantity of goods, whereas the ad valorem rate means fixed percentage of the sale price

rates would matter for revenue performance and would depend on whether the primary aim of the tax policy is to discourage consumption of the excised goods, or to raise more revenue (Cnossen, 2011).

5. Tax transition in developing countries : Empirical framework

5.1 Model specification.

We present the empirical model that serve to our analysis. Since our main objective is to address the role of VAT and excises in the first wave tax transition in developing countries, we present two models that we derive from (Attila et al., 2011) and (Baunsgaard & Keen, 2010).

Equation 1 : Probability model equation

$$Tax\_transition_{it} = \beta_0 + \beta_1 * vat\_adoption_{it} + \beta_2 * LogX_{it} + \beta_3 * vat\_adoption_{it} * LogX_{it} + \mu_i + \xi_{it} \quad (1)$$

Equation 2 : Compensatory effect model

$$Y_{it} = \beta_0 + \beta_1 * trade\_tax_{it} + \beta_2 * trade\_tax_{it}^2 + \beta_3 * X_{it} + \mu_i + \xi_{it} \quad (2)$$

Where $tax\_transition_{it}$ in equation 1 is the transition variable for a country i in year t, $vat\_adoption_{it}$ a dummy of the years over which a country have VAT. Our sample cover 96 developing countries that we collect data on VAT adoption date. The period of the study is constrained to 1985-2013, a period over which most developing countries adopted VAT.

X is the matrix of explanatory variables that we take in logarithm as our preferred identification strategy, and μ_i the unobserved heterogeneity time invariant related to countries that explain their transition process. ξ_{it}, the idiosyncratic error term. We add the interactive terms between VAT and the logarithm of X, to investigate VAT adoption effectiveness depending on structural factors that drive tax potential in developing countries.

In the compensatory model (equation 2), Y is a matrix of dependent variables (VAT, excises). We add the square term of trade tax to investigate for non linear relationships in the compensatory effect between VAT, excises, and trade taxes. When the coefficient β_1 in equation 2 points negative, it indicates a compensatory effect of VAT and excises on trade tax revenues. More additionally, if β_1 and β_2 have the opposite sign, there is a threshold effect of trade tax which is given by :

$$\frac{\partial_Y}{\partial_X} = 0 \Rightarrow \beta_1 + 2\beta_2 * trade\_tax = 0 \Rightarrow trade\_tax^* = \frac{-\beta_1}{2\beta_2} \quad (3)$$

5.2 Data and variables.

5.2.1. Dependent variables.

Tax transition variable in equation 1 was computed according to the methodology outlined in section 2 (Attila et al., 2011). This is a binary variable that take the value 1 if countries met

tax transition and 0 otherwise.

In equation 2 dependent variables of VAT and excises come from International Centre for Tax and Development (ICTD, 2016). All variables are expressed non-resource and in percentage of GDP.

5.2.2 Independent variables.

Explanatory variables include VAT adoption. This variable comes from the IMF tax policy division database, and take the value 1 the period over which a country have VAT, and 0 otherwise. In both equation 1 and equation 2, covariates data concern (i) gdp per capita, (ii) trade openness in percentage of GDP, (iii) natural resources rents in percentage of GDP, and (iv) agriculture value added to GDP. These variables come from the World Development Indicators (WDI, 2016).

Per capita income is expected to be positively correlated with tax transition by its effect on tax revenue, as it expresses the overall level of economic development and the advanced design of tax structure. Moreover, according to Wagner's law, the demand for governments service is often income–elastic, so that, the share of taxes collected by governments to provide goods and services is expected to rise with income (Gupta, 2007).

Trade openness may affect tax transition by its composition effects. If trade openness occurs primarily through reduction in tariffs, one would expect losses in tariff revenues. But, Keen and Simone (2004) argue that, revenue might increase provided trade liberalization occurs through reduction of quotas, elimination of exemptions, and improvement in custom procedures. Aizenman and Jinjarak (2009) highlight the fact that, trade openness should shift tax revenue from "easy to collect taxes" (tariffs and seigniorage taxes) towards "hard to collect taxes" (value added and income taxes). Overall, the effects of trade liberalization on tax revenue and later on tax transition would certainly be indefinite.

Recent challenges in natural resources wealth countries, focused on the 'Dutch disease' effects. Natural resources might affect tax transition by its effect on tax efforts. One aspect of the resource curse may be its impact on a country's incentive to mobilize non-resource domestic tax revenues. For example Moore (2007), argued that, governments relying on resource rents are likely to mobilize less revenue from other sources and this result suggests that, resource rents would lead to low domestic tax efforts that would reduce the likelihood of tax transition.

Agriculture sector is expected to be negatively correlated with tax revenue and thus with tax transition as it remains almost hard to tax agriculture in developing countries. As highlighted by Stotsky and WoldeMariam (1997), this variable almost negatively matter for tax revenue in these countries.

5.3 The probit/logit estimator and the instrumental variable probit regression.

As the paper aims to address the effect of having VAT on tax transition, our model is a qualitative response model with a binary dependent variable. The econometric identification problem of this model is to estimate the conditional probability that the dependent variable being one, as a function of the covariates. Ordinary least square estimators are seriously biased because the conditional probability of the dependent variable, is not necessarily bounded between zero and one (Horowitz & Savin, 2001). This default can be corrected by replacing the linear function by a cumulative distribution function that constrained the conditional probability to lie between zero and one. The commonly used cumulative distribution functions are the distribution functions of a normal distribution or a logistic distribution which use the maximum likelihood estimators, and have very similar properties in large sample.

Nevertheless, estimating the causal effect of having VAT on tax transition in equation 1, is subject to endogeneity bias on the fact that, there is a simultaneity between having VAT and tax transition. In other words, adoption of VAT has an effect on tax transition, but a country undergoing a tax transition reform may want to adopt VAT. We need instrumental variables to solve the endogeneity of VAT adoption. Ufier (2014), establish several factors that drive VAT adoption in developing countries. Ebeke (2011), uses neighborhood effects to instrument VAT adoption. Keen and Lockwood (2010) show that, countries under IMF lending programs are more likely to adopt VAT to pay off their debts both by necessity, but also because of the IMF encouragement to adopt VAT. We instrument VAT adoption with the share of neighbors that adopted VAT before the given country, and with a dummy variable that represents a country involvement in IMF‘s assistance programs. For trade taxes, this variable was instrumented with trade tax effective rate, and its first lag. The basic underlined idea is that, if trade tax revenues are affected by trade liberalization, effective collected tariff rates may explain the revenue it generated, but not revenue generated by VAT.

6. Results

Table 3 reports results of probit estimation of equation 1. We report the marginal effect in each column of table 3. We made various estimates and based our result on the instrumental variable probit regression in which we deal with the endogeneity of VAT adoption. Basically, our results in column 4 show that, VAT has tended to positively and significantly affect tax transition in developing countries. In particular, the marginal effect in column 4 indicates that, the probability of succeeding tax transition increases by near 10%, when a country adopts VAT. In column 5, the interactive term of VAT and the variable of income per capita shows that, high income developing countries are more likely to succeed tax transition with VAT as compared to low income developing countries. Furthermore, our results in column 7 suggest a

threshold effect of VAT considering the negative effect of the interactive term with the variable of agriculture, and the positive effect of the variable of VAT adoption. This means that, VAT still positively affects tax transition in developing countries with a ratio of agriculture to GDP less than 20 percentage points. Due to the self-consumption and exemptions of most agricultural commodities, the beneficial effect of VAT tends to diminish when a country's agriculture to GDP ratio becomes more important (Stotsky & WoldeMariam, 1997; Chambas & Araujo Bonjean, 2001).

Table 3: Baseline estimate, probability model, marginal effect

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Linear probability tax transition	Logit tax transition	Probit tax transition	IV probit tax transition	IV probit tax transition	IV probit tax transition	IV probit tax transition	IV probit tax transition
Vat adoption	0.0894***	0.0968**	0.0932**	0.0975**	0.114**	0.146	0.107**	0.114**
	(0.0201)	(0.0378)	(0.0365)	(0.0344)	(0.0529)	(0.0897)	(0.0504)	(0.0501)
Log(gdp capita)	0.0292**	0.0383*	0.0391*	0.0307**	0.0700*	0.0216*	0.0331***	0.0317***
	(0.0118)	(0.0224)	(0.0221)	(0.0127)	(0.0416)	(0.0114)	(0.0113)	(0.0121)
Log(trade)	-0.0200	0.00968	0.0101	-0.0206	-0.0302	-0.0228	-0.0294	-0.0293
	(0.0186)	(0.0365)	(0.0358)	(0.0191)	(0.0228)	(0.0204)	(0.0215)	(0.0182)
Log(agriculture)	-0.0519***	-0.0683**	-0.0678**	-0.0540***	-0.0516***	-0.0469**	-0.0582***	-0.0523***
	(0.0150)	(0.0284)	(0.0281)	(0.0163)	(0.0174)	(0.0189)	(0.0174)	(0.0155)
Log(resources rents)	-0.0253***	-0.0316***	-0.0311***	-0.0260***	-0.0266***	-0.0251***	-0.0215***	-0.0525***
	(0.00501)	(0.0102)	(0.0101)	(0.00518)	(0.00533)	(0.00562)	(0.00703)	(0.00867)
Log(gdp capita)*vat adoption					0.135**			
					(0.0687)			
Log(trade)*vat adoption						-0.2020		
						(0.195)		
Log(agriculture)*vat adoption							-0.0348**	
							(0.0127)	
Log(resources rents)*vat adoption								0.0240
								(0.0175)
Constant	0.0172							
	(0.146)							
Observations	2,401	2,401	2,401	2,401	2,401	2,401	2,401	2,401
R-squared	0.027							
Number of country code	96	96	96	96	96	96	96	96
Wald test of exogeneity				0.9125	0.6001	0.4770	0.7237	0.4605

Robust standard errors in parentheses

***p<0.01, ** p<0.05, * p<0.1

Table 4 reports results for the compensatory effect between VAT and excises. We also made various estimates and based our results on the instrumental variable estimate in column 4 and 8. Our results in column 4 suggest that, a decrease of one percentage point of trade tax revenue to GDP, leads to an increase of 0.67 percentage points of VAT. More specifically, the loss of one percentage point of trade tax revenues to GDP, is offset by an increase of 0.67 percentage points of VAT. In other words, developing countries are offsetting 67% of their trade tax revenues with VAT. In the same column, our results suggest that, this effect is non-linear. Indeed, the positive

sign of the square term and the appropriate threshold effect indicates that, the compensatory effect holds only if the decrease in trade tax revenue does not exceed 6 percentage points of GDP (VAT exhibit an U relationship with trade tax).

The average compensation ratio less than one, might tell us that, VAT tax efforts need to be increased if the primary goal of first wave tax transition by VAT is to make VAT a powerful tax transition tool. In column 8, results suggest that, excises are offsetting for revenue losses, once the decrease in trade tax revenue reached 4 percentage points of GDP (we find an U inverted relationship between trade tax and excises with a turning point at 4percentage points of GDP). Thus, the study points out a complementarity effect between VAT and excises in the interval of trade tax revenue between [4-6] points of GDP. Outside this interval of complementarity, VAT still works for revenue losses below 4percentage points of trade tax to GDP with a two-thirds-to-one ratio.

Table 4: Compensatory and complementarity effect between VAT and excises

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Fixed effect	Random effect	IV	IV	Fixed effect	Random effect	IV	IV
VARIABLES	vat	vat	vat	vat	excises	excises	excises	excises
Trade tax	-0.290***	-0.287***	-0.404***	-0.672***	0.0127	0.0199	0.0204	0.382*
	(0.0859)	(0.0816)	(0.0446)	(0.139)	(0.0288)	(0.0259)	(0.0177)	(0.195)
Log(gdp capita)	1.610***	1.206***	1.512***	1.397***	0.214**	0.0888	0.213***	0.193**
	(0.472)	(0.361)	(0.179)	(0.196)	(0.0889)	(0.0896)	(0.0711)	(0.0767)
Trade	0.00200	0.00269	0.00270	0.00215	-0.00114	-0.00101	-0.00749	-0.00652
	(0.00381)	(0.00378)	(0.00191)	(0.00192)	(0.00154)	(0.00136)	(0.00500)	(0.00591)
Agriculture	-0.0479*	-0.0513**	-0.0469***	-0.0476***	-0.00795*	-0.00876**	-0.00761**	-0.00749**
	(0.0244)	(0.0234)	(0.00764)	(0.00771)	(0.00429)	(0.00409)	(0.00348)	(0.00347)
Resources rents	0.00530	0.00364	0.00210	0.00176	0.00550	0.00237	0.00563	0.00569
	(0.0142)	(0.0135)	(0.00579)	(0.00583)	(0.00646)	(0.00619)	(0.00452)	(0.00451)
$Trade\_tax^2$				0.0535***				-0.0474**
				(0.0116)				(0.0218)
Constant	-6.050	-2.939			3.561***	2.635***		
	(4.008)	(3.178)			(1.090)	(0.750)		
Observations	2,784	2,784	2,688	2,688	2,784	2,784	2,688	2,688
R-squared	0.195		0.193	0.179	0.004		0.004	0.004
Number of country_code	96	96	96	96	96	96	96	96
Hansen P-value			0.284	0.213			0.4428	0.5503

Robust standard errors in parentheses

***p<0.01, ** p<0.05, * p<0.1

7. Sensitivity analysis

7.1 Is our result robust to sub-sample diversities ?

Our assumption is that tax systems vary across countries and regions of developing world. For example, while African countries have an emerging VAT mostly with single VAT rate but with numerous exemptions, Asian countries adopted low VAT rate, substantial rate dispersion and few exempt goods. These trends differ considering Latin American countries that have VAT almost at high rate, with reduced VAT rate and few VAT exemptions. We make sensitivity analysis to ensure that VAT is performing well wherever it is adopted and that its adoption is effectively driving tax transition over different areas of developing countries. Investigating such heterogeneities is essential to address the effectiveness of VAT in tax transition over developing countries.

Table 5 reports results on the sub-group of African countries while estimating equation 1. Results obtained on this table indicate that, VAT adoption effect is robust to Sub-Saharan African countries. Sub-Saharan African countries are also taking hold of VAT adoption to increase their probability of succeeding transition. Indeed, for this group of countries, according to results in column 4, the probability of succeeding transition increases by 12% when they have VAT. We do not find any differential effect depending on the level of per capita income, but findings in column 8 suggest that, the presence of natural resources made it unlikely to succeed tax transition. The beneficial effect of VAT tends to diminish as countries become more resource-depending (above 12 percentage points of GDP). To facilitate resource extractive activities, African governments often grant VAT exemptions to investors in the mining code for several years, to imported capital goods used in these activities, that may explain this situation.

Table 6 replicates estimates of equation 2 on the same group of African countries. It indicates in column 4 that, Sub-Saharan African countries are less able to offset for their trade tax revenue as compared to the rest of developing countries. They can offset only about half of any unit lost on international trade with VAT. Even if VAT adoption made it possible to succeed transition in these countries, they have less compensation ratio with VAT regarding trade tax revenue losses. This can be explained by several exemptions and derogatory regimes in African countries, which for the most time, erodes VAT tax base and reduce VAT revenue performance. We find a turning point at 7 percentage points of trade tax to GDP. Later on, results indicate that, excises are offsetting for about 8% trade tax revenue in these countries and that, VAT and excises are complementary for about a compensation ratio of 59%.

In table 7, we replicate estimates of equation 1 on the sub-group of Asian countries. Results indicate that, our findings are consistent with this sub-group of countries. Estimates in column 4 suggest that, Asian countries increase their likelihood of succeeding tax transition by 8.1%, also because of VAT. Then VAT appears as an important tool in developing countries that help

succeeding transition. We find that this effect is reinforced with the level of per capita income (column 5), but as agriculture becomes more important in terms of GDP (above 15 percentage points of agriculture to GDP), it reduces the likelihood of succeeding tax transition with VAT (column 7). This is not surprising since agriculture is almost hard to tax in developing countries and that, most of agricultural goods are often self-consumed.

Estimating equation 2 on the same group of countries, results indicate in table 8 that, Asian countries like African countries are not performing well in offsetting trade tax revenue losses with VAT. As it can be observed in column 4 of table 8, these countries have a similar compensation ratio as African countries about half. The major challenge in Asian countries to manage an efficient VAT has by far consisted in their dual VAT system, where VAT would be levied by the central government and by states. This has created differentiation in VAT rates between states and central government, and within states. These factors exacerbate VAT refunds issues, that deal with their VAT revenue performance. The positive sign of the square term indicates a threshold effect at 4 percentage points of trade tax to GDP. Finally, results suggest that, excises are not offsetting for trade tax revenues in Asian countries, and that, they remain ineffective in their transition process.

The last check was made on the group of LAC [7] countries. Estimates of equation 1 is presented in table 9 and reveal that the results are not robust for this group of countries. VAT is showing a negative effect on tax transition for this sub-group of countries. Even if not significative, this effect could tell us better about the fact that, VAT doesn't necessarily show an increasing return with its duration of use, since stylized facts highlight that, under IMF's assistance programs, most of LAC countries were the first to adopt VAT. Our results may support another concern which is the fact that, VAT is not necessarily exhibiting marginal increasing returns with its duration of use. We later made another additional check about this statement by introducing the number of years a country have VAT in the model.

Replicating estimates of equation 2 on this sub-group of LAC countries, results in table 10 suggest that, LAC countries are offsetting well their trade tax revenues with VAT as compared to African et Asian countries. Indeed, these countries can offset 73.8% of their trade tax revenue losses with VAT. This result doesn't challenge our findings in table 9, since tax transition is not bounded in offsetting trade tax revenues, but a country needs to perform overall positive tax efforts over the period of interest (stronger hypothesis). This is an explanation to results obtained on this sub-group, since recent studies almost find that, LAC countries are showing constant decrease in their tax efforts over recent years (Alm & Martinez-Vazquez, 2007; Brun et al., 2014). Further, one additional explanation is that, VAT tax efforts is offset by reduced tax efforts from other taxes that reduce the probability of succeeding tax transition with VAT.

[7] LAC Latin America and Carribean

The positive sign of the square term indicates a turning point at 6 points of trade tax to GDP. Finally, we find that excises react to trade tax revenue losses in LAC countries, once the decrease in this tax reached 2 percentage points of GDP. Thus, the complementarity effect between VAT and excises holds in this region, if the decrease in trade tax lie between [2-6] points of GDP.

7.2 The case of WAEMU countries.

In this section we focus notably on west african economic and monetary union for the following reasons: first during the early 2000s they adopt common external tariff that limit trade diversion in the process of their trade liberalization concerns. Second WAEMU is a regional integration area where tax coordination between countries is almost advanced, especially that targeting indirect taxes like VAT. Measures aimed at converging VAT tax base and rates in order to limit tax competition and enhance the neutrality of this tax (Mansour & Rota-Graziosi, 2012). Excises were also coordinated accross countries notably excisable goods, and their minimum and maximum rates (Mansour & Rota-Graziosi, 2012). Finally, countries in this area expressly adopt tax transition reforms during the 2006s that limit the revenue contribution of trade taxes as compared to inside domestic revenue mobilization.

We aim in this section to assess the likelihood of succeding tax transition by VAT in these countries as well quantify the compensation ratio with VAT and excises. Results are given in table 11 and 12.

Overall our results suggest that WAEMU countries are more likely to succeed tax transition than the rest of countries. This result is given in column 4 of table 11. The probability of meeting transition (21%) is higher than the one obtained on total sample. We do not find any nonlinear relationship in table 12 concerning the compensation ratio. This is not surprising since the adoption of common external tariff limit the scope of revenue losses of their trade liberalization process. However we do not find strong evidence suggesting that they do well in offsetting trade tax revenue losses with VAT. Thus, the fact that they have greater probability of succeeding transition can simply be due to coordination measures that help enhance domestic revenue. Finally we find that excises compensate for 18% trade tax revenue losses and are complementary with VAT for about 70%.

7.3 Do the number of years a country have VAT matter ?

This check was made to investigate whether the seniority of VAT increases the return of this tax in the transition process of developing countries by a cumulative effect, or if it still be an art to manage VAT. Omission of such variable may lead to « omitted variable bias » in the model since it can affect VAT productivity. Our main assumption is that countries can gain sufficient experiences with the adopted VAT, its management and it can affect the likelihood of succeeding tax transition with VAT. This issue is not sufficiently addressed in the literature. Results obtained in table 13 contrary evidence that, VAT management still be an art in the sense that, its seniority doesn't affect the probability of succeeding transition in developing countries. Further, adding this variable doesn't challenge as so far our VAT adoption effect on tax transition.

7.4 Changing the dependent variable.

7.4.1 Hardening transition condition 1.

We make a check with the main assumption that a country must unavoidably reach its entire tax potential. We revise and improve Attila et al. (2011), first condition, since it must overestimate tax efforts of developing countries. We bring the norm of tax revenue to 100% of tax potential. We make this check to ensure that, countries are still meeting transition challenge with VAT even after hardening tax efforts conditions. Results are given in table 14.

We observe in column 4 that, VAT still positively and significantly affects the likelihood of succeeding tax transition in these countries, which can be interpreted as a qualitative effect of VAT. But the likelihood of succeeding transition falls to 4.1% (quantitative effect). Thus, tax efforts strongly matter, if one wants to address transition performance in developing countries.

7.4.2 Allowing for 3 years interval period (assumption 2 and 3 of condition 2).

We constrained increases and decreases in domestic tax revenues and trade tax revenues over a period of three years as in Diarra (2012). Compared to the baseline estimate, this check is performed to assess to what extent, domestic taxes are performing in offsetting trade tax over a reduced period of three years perhaps because of VAT. Results are given in table 15.

It can be interpreted as follows : First, VAT still remains an important factor that help countries succeeding tax transition since it still positively and significantly affects tax transition in these countries. Second, confronting this estimate to our baseline estimate, we observe that the likelihood of succeeding transition falls to 7%. This result suggests that domestic revenue is like to cover that of international trade truly in the mid-term.

7.4.3 Taking into account the duration of tax transition.

We change the binary nature of our dependent variable to take into account the duration of tax transition. Indeed, when a country meet tax transition the first year, this is coded 1. In the following year, instead of coding 1, we introduce the notion of duration considering that he is meeting tax transition the 2nd year (twice) and so forth. Thus, our dependent variable this time represents the number of years the country is meeting tax transition. We have a duration model of tax transition with a left censored observation at 0. We introduce duration to investigate not whether VAT adoption increase the probability of succeeding tax transition but rather if it increases the duration of tax transition. Following innovations to deal with this type of data (Amemiya, 1984), we use tobit maximum likelihood estimators to estimate the model and to derive marginal effects. Resuts are given in table 16.

Our results are still robust and indicate that VAT extends for about 2 years the duration of tax transition in developing countries. This result is given in column 2 of table 16.

7.5 Investigating for asymmetries.

Another concern of this paper is to investigate for asymmetries. Do VAT and excises revenues increase in developing countries, the period over which trade tax revenue increases? Investigating the quality of the transition process need to address empirically this issue to ensure that, VAT and excises are performing well and that, transition process with these instruments is continuous. Results in table 17 suggest that, neither VAT nor excises are increasing significantly over the period where trade tax revenues increase. Thus, this study shows that, first wave tax transition in developing countries even strengthened by VAT and excises, doesn't seem irreversible. VAT and excises systems do not react significantly to the rise in tax base. We suspect a compliance gap in mobilizing VAT revenue over this period. Thus, VAT and excises policies merit more close attention, to address empirically the robustness of VAT and excises as powerful effective first wave tax transition tools in developing countries.

Table 5: Estimation on the sub-group of African countries : Probability model (equation1)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Linear probability tax transition	Logit tax transition	Probit tax transition	IV probit tax transition	IV probit tax transition	IV probit tax transition	IV probit tax transition	IV probit tax transition
Vat adoption	0.108***	0.122**	0.110**	0.120**	0.138	0.104	0.116	0.120**
	(0.0277)	(0.0582)	(0.0547)	(0.0592)	(0.1076)	(0.0955)	(0.0967)	(0.0585)
Log(gdp capita)	0.0336	0.0359	0.0386	0.0378	0.0812	0.0408	0.0397	0.0346
	(0.0232)	(0.0329)	(0.0311)	(0.0277)	(0.0925)	(0.0303)	(0.0291)	(0.0288)
Log(trade)	-0.0665*	-0.0660	-0.0625	-0.0858*	-0.100*	-0.0392	-0.0818	-0.0824*
	(0.0360)	(0.0736)	(0.0694)	(0.0448)	(0.0552)	(0.0251)	(0.0528)	(0.0452)
Log(agriculture)	-0.0471	-0.0447	-0.0453	-0.0486	-0.0475	-0.0493	-0.0204	-0.0444
	(0.0296)	(0.0438)	(0.0421)	(0.0321)	(0.0340)	(0.0332)	(0.0878)	(0.0338)
Log(resources rents)	-0.0515***	-0.0581***	-0.0561***	-0.0561***	-0.0566***	-0.0564***	-0.0476	-0.0455**
	(0.0100)	(0.0163)	(0.0155)	(0.0118)	(0.0121)	(0.0122)	(0.0357)	(0.0203)
Log(gdp capita)*vat adoption					0.0697			
					(0.155)			
Log(trade)*vat adoption						-0.0116		
						(0.0111)		
Log(agriculture)*vat adoption							-0.0461	
							(0.0131)	
Log(resources rents)*vat adoption								-0.0474*
								(0.0266)
Constant	0.212							
	(0.257)							
Observations	1,073	1,073	1,073	1,073	1,073	1,073	1,073	1,073
R-squared	0.045							
Number of country_code	37	37	37	37	37	37	37	37
Wald test of exogeneity				0.8223	0.8662	0.8318	0.9837	0.7793

Robust standard errors in parentheses

***p<0.01, ** p<0.05, * p<0.1

Table 6: Compensatory and complementarity effect between VAT and excises : African countries

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Fixed effect vat	Random effect vat	IV vat	IV vat	Fixed effect excises	Random effect excises	IV excises	IV excises
Trade tax	-0.166**	-0.175**	-0.261***	-0.517***	-0.0440***	-0.0500***	-0.0510**	-0.0806*
	(0.0752)	(0.0768)	(0.0500)	(0.163)	(0.0128)	(0.0124)	(0.0239)	(0.0494)
Log(gdp capita)	2.659***	2.192***	2.532***	2.386***	0.131	0.160	0.143	0.159
	(0.506)	(0.427)	(0.252)	(0.278)	(0.246)	(0.209)	(0.102)	(0.107)
Trade	0.000149	0.000354	0.000502	-0.000111	0.000412	0.000486	0.000625	0.000559
	(0.00311)	(0.00311)	(0.00230)	(0.00236)	(0.000805)	(0.000769)	(0.00107)	(0.00111)
Agriculture	-0.0241	-0.0272**	-0.0228***	-0.0223***	-0.0106*	-0.0111*	-0.0101**	-0.0100**
	(0.0150)	(0.0139)	(0.00727)	(0.00734)	(0.00607)	(0.00606)	(0.00430)	(0.00432)
Resources rents	0.0300**	0.0234	0.0252***	0.0245***	-0.000917	-0.00137	-0.000934	-0.00101
	(0.0147)	(0.0153)	(0.00652)	(0.00652)	(0.00301)	(0.00286)	(0.00245)	(0.00245)
$Trade\_tax^2$				0.0369**				0.0031
				(0.0152)				(0.0052)
Constant	-13.15***	-9.814***			2.622	2.857*		
	(3.617)	(3.088)			(1.763)	(1.529)		
Observations	1,073	1,073	1,036	1,036	1,073	1,073	1,036	1,036
R-squared	0.224		0.208	0.192	0.023		0.025	0.026
Number of country_code	37	37	37	37	37	37	37	37
Hansen P-value			0.4919	0.4344			0.8377	0.8322

Robust standard errors in parentheses

***p<0.01, ** p<0.05, * p<0.1

Table 7: South East and Pacific Asia : Probability model (equation 1).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Linear probability tax transition	Logit tax transition	Probit tax transition	IV probit tax transition	IV probit tax transition	IV probit tax transition	IV probit tax transition	IV probit tax transition
Vat adoption	0.0705***	0.0785**	0.0720**	0.0812**	0.1132*	0.1295	0.1391*	0.0972**
	(0.0217)	(0.0302)	(0.0297)	(0.0379)	(0.0631)	(0.0800)	(0.0822)	(0.0348)
Log(gdp capita)	0.00360	0.0112	0.0123	0.0146	0.112*	0.0333	0.00272	0.00598
	(0.0210)	(0.0335)	(0.0331)	(0.0223)	(0.0676)	(0.0223)	(0.0174)	(0.0217)
Log(trade)	0.0355	0.0559	0.0559	0.0342	0.0327	0.0738	0.0398	0.0236
	(0.0304)	(0.0423)	(0.0422)	(0.0313)	(0.0339)	(0.0633)	(0.0262)	(0.0309)
Log(agriculture)	-0.0719***	-0.0905**	-0.0918**	-0.0746**	-0.0842***	-0.0123	-0.1444**	-0.0788***
	(0.0272)	(0.0387)	(0.0387)	(0.0297)	(0.0323)	(0.0342)	(0.0511)	(0.0293)
Log(resources rents)	-0.0275***	-0.0322**	-0.0322**	-0.0295***	-0.0340***	-0.00470	-0.0123	-0.0648***
	(0.00886)	(0.0136)	(0.0134)	(0.00956)	(0.0106)	(0.0124)	(0.00986)	(0.0184)
Log(gdp capita)*vat adoption					0.146**			
					(0.0706)			
Log(trade)*vat adoption						-0.0947		
						(0.0598)		
Log(agriculture)*vat adoption							-0.0516**	
							(0.0200)	
Log(resources rents)*vat adoption								0.0310
								(0.0203)
Constant	-0.00169							
	(0.288)							
Observations	754	754	754	754	754	754	754	754
R-squared	0.019							
Number of country_code	26	26	26	26	26	26	26	26
Wald test of exogeneity				0.5159	0.7682	0.8614	0.5890	0.9628

Robust standard errors in parentheses

***p<0.01, ** p<0.05, * p<0.1

Table 8: Compensatory and complementarity effect between VAT and excises : Asian countries

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Fixed effect vat	Random effect vat	IV vat	IV vat	Fixed effect excises	Random effect excises	IV excises	IV excises
Trade tax	-0.241***	-0.227***	-0.295***	-0.497**	0.0254	0.0227	0.0133	0.105
	(0.0555)	(0.0550)	(0.0728)	(0.2476)	(0.0998)	(0.0928)	(0.0475)	(0.109)
Log(gdp capita)	-0.478	-0.194	-0.412	-0.460	-0.202	-0.0101	-0.140	-0.0611
	(1.128)	(0.986)	(0.349)	(0.384)	(0.215)	(0.144)	(0.114)	(0.134)
Trade	0.0146*	0.0115	0.0145***	0.0145***	0.000843	0.000446	0.00128	0.00122
	(0.00848)	(0.00802)	(0.00348)	(0.00350)	(0.00250)	(0.00189)	(0.00169)	(0.00168)
Agriculture	-0.101	-0.0948	-0.102***	-0.103***	-0.000832	-0.000975	0.000471	0.00239
	(0.0766)	(0.0731)	(0.0196)	(0.0200)	(0.0161)	(0.0161)	(0.00648)	(0.00666)
Resources rents	0.00513	0.00238	0.00469	0.00811	0.0208	0.00950	0.0192***	0.0180**
	(0.0309)	(0.0288)	(0.0147)	(0.0169)	(0.0196)	(0.0177)	(0.00712)	(0.00721)
$Trade\_tax^2$				0.0561*				0.0231
				(0.0296)				(0.0147)
Constant	9.536	7.400			3.431*	1.872		
	(10.62)	(9.494)			(1.773)	(1.460)		
Observations	754	754	728	728	754	754	728	728
R-squared	0.216		0.232	0.230	0.007		0.006	0.006
Number of country_code	26	26	26	26	26	26	26	26
Hansen P-value			0.180	0.321			0.3433	0.6178

Robust standard errors in parentheses

***p<0.01, ** p<0.05, * p<0.1

Table 9: Latin America and Caribbean : Probability model (equation 1).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Linear probability tax transition	Logit tax transition	Probit tax transition	IV probit tax transition	IV probit tax transition	IV probit tax transition	IV probit tax transition	IV probit tax transition
Vat adoption	-0.110	-0.0713	-0.0688	-0.105	-0.117	-0.120	-0.0553	-0.0577
	(0.0770)	(0.102)	(0.0977)	(0.129)	(0.166)	(0.185)	(0.0804)	(0.0834)
Log(gdp capita)	0.159***	0.206*	0.209*	0.168***	0.239	0.167***	0.171***	0.169***
	(0.0389)	(0.112)	(0.111)	(0.0448)	(0.310)	(0.0460)	(0.0434)	(0.0443)
Log(trade)	-0.0838**	-0.0589	-0.0562	-0.0878**	-0.0750	-0.146	-0.0778*	-0.0767*
	(0.0386)	(0.0670)	(0.0660)	(0.0442)	(0.0591)	(0.319)	(0.0459)	(0.0412)
Log(agriculture)	-0.106***	-0.107	-0.109	-0.108**	-0.116**	-0.113**	-0.0604***	-0.115***
	(0.0383)	(0.0741)	(0.0743)	(0.0461)	(0.0483)	(0.0446)	(0.0165)	(0.0440)
Log(resources rents)	0.00810	0.00259	0.00226	0.00688	0.00908	0.00858	0.00828	0.0984
	(0.0151)	(0.0244)	(0.0243)	(0.0176)	(0.0165)	(0.0164)	(0.0161)	(0.0818)
Log(gdp capita)*vat adoption					-0.0712			
					(0.119)			
Log(trade)*vat adoption						0.0699		
						(0.0962)		
Log(agriculture)*vat adoption							-0.0583	
							(0.0811)	
Log(resources rents)*vat adoption								0.0209
								(0.0249)
Constant	-0.962**							
	(0.457)							
Observations	609	609	609	609	609	609	609	609
R-squared	0.043							
Number of country_code	21	21	21	21	21	21	21	21
Wald test of exogeneity				0.8915	0.7267	0.7593	0.9585	0.6778

Robust standard errors in parentheses

***p<0.01, ** p<0.05, * p<0.1

Table 10: Compensatory and complementarity effect between VAT and excises : LAC countries

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Fixed effect vat	Random effect vat	IV vat	IV vat	Fixed effect excises	Random effect excises	IV excises	IV excises
Trade tax	-0.235	-0.243	-0.393**	-0.738***	0.0594**	0.0707**	0.0621*	0.0814*
	(0.186)	(0.190)	(0.153)	(0.316)	(0.0254)	(0.0242)	(0.0329)	(0.0454)
Log(gdp capita)	2.258*	1.907*	2.024***	1.509***	0.395	0.283	0.367**	0.293
	(1.161)	(0.979)	(0.483)	(0.562)	(0.297)	(0.247)	(0.154)	(0.179)
Trade	0.0167*	0.0179**	0.0193***	0.0218***	-0.00400	-0.00412*	-0.00416***	-0.00452***
	(0.00868)	(0.00808)	(0.00389)	(0.00402)	(0.00242)	(0.00212)	(0.00117)	(0.00123)
Agriculture	-0.101	-0.0928	-0.0970***	-0.106***	-0.00149	-0.00644	-0.00224	-0.000907
	(0.0637)	(0.0618)	(0.0233)	(0.0240)	(0.0138)	(0.0133)	(0.00711)	(0.00714)
Resources rents	-0.0604	-0.0541	-0.0592***	-0.0636***	-0.000667	-0.00333	-0.000719	-0.000872
	(0.0465)	(0.0454)	(0.0199)	(0.0199)	(0.0126)	(0.0123)	(0.00740)	(0.00783)
$Trade\_tax^2$				0.0602**				-0.0201**
				(0.0259)				(0.0100)
Constant	-12.76	-10.03			5.148*	4.274*		
	(9.891)	(8.327)			(2.531)	(2.235)		
Observations	609	609	588	588	609	609	588	588
R-squared	0.225		0.213	0.212	0.067		0.063	0.066
Number of country_code	21	21	21	21	21	21	21	21
Hansen P-value			0.1269	0.1830			0.1849	0.1486

Robust standard errors in parentheses

***p<0.01, ** p<0.05, * p<0.1

Table 11: Case WAEMU countries: Probability model

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Linear probability	Logit	Probit	IV_probit	IV_probit	IV_probit	IV_probit	IV_probit
VARIABLES	tax_transition	tax_transition	tax_transition	tax_transition	tax_transition	tax_transition	tax_transition	tax_transition
Vat adoption	0.174**	0.290**	0.275***	0.213*	0.681	0.597	-0.554	0.159
	(0.0709)	(0.119)	(0.103)	(0.128)	(1.523)	(1.123)	(1.914)	(0.842)
Log(gdp capita)	-0.0864	-0.212	-0.195	-0.116	-0.0667	-0.115	-0.1000	-0.101
	(0.111)	(0.205)	(0.184)	(0.121)	(0.635)	(0.125)	(0.209)	(0.199)
Log(trade)	0.0292	0.300	0.289	0.0377	0.0479	0.108	0.0370	0.0300
	(0.134)	(0.488)	(0.468)	(0.141)	(0.143)	(0.575)	(0.136)	(0.162)
Log(agriculture)	-0.379**	-0.200	-0.198	-0.418**	-0.421*	-0.432*	-0.587	-0.407**
	(0.180)	(0.323)	(0.318)	(0.184)	(0.230)	(0.227)	(0.516)	(0.197)
Log(resources rents)	0.0565	-0.0380	-0.0290	0.0551	0.0457	0.0627	0.0497	0.0383
	(0.0729)	(0.0885)	(0.0875)	(0.0795)	(0.0802)	(0.0971)	(0.0775)	(0.276)
Log(gdp capita)*vat adoption					-0.0712			
					(0.726)			
Log(trade)*vat adoption						-0.0933		
						(0.784)		
Log(agriculture)*vat adoption							0.217	
							(0.779)	
Log(resources rents)*vat adoption								0.0261
								(0.353)
Constant	1.845							
	(1.141)							
Observations	232	232	232	232	232	232	232	232
R-squared	0.068							
Number country code	8	8	8	8	8	8	8	8
Wald test of exogeneity				0.8884	0.5057	0.9131	0.6444	0.8669

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 12: Compensatory and complementarity effect: WAEMU countries

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Fixed effect	Random effect	IV	IV	Fixed effect	Random effect	IV	IV
VARIABLES	vat	vat	vat	vat	excises	excises	excises	excises
Trade_tax	-0.211**	-0.196***	-0.229***	-0.520*	-0.0797**	-0.0813***	-0.0881***	-0.187*
	(0.0737)	(0.0681)	(0.0712)	(0.311)	(0.0245)	(0.0260)	(0.0221)	(0.105)
Log(gdp capita)	5.488***	2.837***	5.231***	5.110***	1.235**	0.958***	1.255***	1.231***
	(1.038)	(0.652)	(0.640)	(0.641)	(0.409)	(0.352)	(0.198)	(0.197)
Trade	-0.00163	-0.0376**	0.00214	0.00161	0.00406	0.00347	0.00400	0.00390
	(0.0213)	(0.0164)	(0.0103)	(0.0107)	(0.00293)	(0.00306)	(0.00338)	(0.00340)
Agriculture	-0.140*	-0.140***	-0.130***	-0.129***	-0.00326	-0.00507	-0.00162	-0.00145
	(0.0650)	(0.0199)	(0.0248)	(0.0257)	(0.00494)	(0.00545)	(0.00595)	(0.00609)
Resources rents	0.0750*	0.0670	0.0659***	0.0619***	0.00608	0.00816	0.00520	0.00442
	(0.0365)	(0.0421)	(0.0239)	(0.0227)	(0.00723)	(0.00682)	(0.00694)	(0.00713)
$Trade\_tax^2$				0.0590				0.0120
				(0.0622)				(0.0117)
Constant	-26.84***	-7.654**			-7.062**	-5.197**		
	(5.378)	(3.428)			(2.700)	(2.268)		
Observations	232	232	224	224	232	232	224	224
R-squared	0.357		0.341	0.329	0.258		0.261	0.257
Number of country_code	8	8	8	8	8	8	8	8
Hansen P-value			0.3359	0.3597			0.5418	0.6734

Robust standard errors in parentheses

***p<0.01, ** p<0.05, * p<0.1

Table 13: Robustness check adding the number of year a country have VAT.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Linear probability	Logit	Probit	IV probit	IV probit	IV probit	IV probit	IV probit
VARIABLES	tax transition	tax transition	tax transition	tax transition	tax transition	tax transition	tax transition	tax transition
Vat adoption	0.0801***	0.0932**	0.0899**	0.0698*	0.1028*	0.1387	0.1087*	0.0144
	(0.0259)	(0.0448)	(0.0435)	(0.0398)	(0.0612)	(0.1040)	(0.0636)	(0.0180)
Log(gdp capita)	0.0280**	0.0375*	0.0383*	0.0292**	0.0549	0.0215	0.0250	0.0287**
	(0.0120)	(0.0227)	(0.0224)	(0.0126)	(0.0392)	(0.0163)	(0.0340)	(0.0117)
Log(trade)	-0.0199	0.00901	0.00949	-0.0203	-0.0265	-0.0121	-0.0289	-0.0289
	(0.0186)	(0.0364)	(0.0358)	(0.0190)	(0.0222)	(0.0165)	(0.0178)	(0.0176)
Log(agriculture)	-0.0521***	-0.0686**	-0.0682**	-0.0540***	-0.0531***	-0.0479**	-0.0697***	-0.0517***
	(0.0150)	(0.0280)	(0.0278)	(0.0162)	(0.0171)	(0.0190)	(0.0131)	(0.0151)
Log(resources rents)	-0.0256***	-0.0319***	-0.0313***	-0.0263***	-0.0270***	-0.0255***	-0.0168***	-0.0544***
	(0.00501)	(0.00994)	(0.00988)	(0.00512)	(0.00528)	(0.00562)	(0.00399)	(0.00861)
Log(gdp capita)*vat adoption					0.1354			
					(0.0855)			
Log(trade)*vat adoption						-0.212		
						(0.149)		
Log(agriculture)*vat adoption							0.214	
							(0.151)	
Log(resources rents)*vat adoption								0.0405
								(0.0306)
Constant	0.0247							
	(0.147)							
Number year vat	0.000755	0.000360	0.000332	0.00133	0.00172	0.000674	0.00416	0.00245
	(0.00135)	(0.00212)	(0.00210)	(0.00204)	(0.00136)	(0.00147)	(0.00945)	(0.00199)
Observations	2,755	2,755	2,755	2,755	2,755	2,755	2,755	2,755
R-squared	0.021							
Number of country_code	96	96	96	96	96	96	96	96
Wald test of exogeneity				0.7442	0.3365	0.5668	0.8618	0.3228

Robust standard errors in parentheses

***p<0.01, ** p<0.05, * p<0.1

Table 14: Hardening transition condition 1.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Linear probability	Logit	Probit	IV probit	IV probit	IV probit	IV probit	IV probit
VARIABLES	tax_transition(2)	tax_transition(2)	tax_transition(2)	tax_transition(2)	tax_transition(2)	tax_transition(2)	tax_transition(2)	tax_transition(2)
Vat adoption	0.0450***	0.0508**	0.0496**	0.0411*	0.0974**	0.1087	0.1079*	0.0341
	(0.0169)	(0.0252)	(0.0245)	(0.0217)	(0.0357)	(0.0811)	(0.0636)	(0.0333)
Log(gdp capita)	0.0266***	0.0285**	0.0296**	0.0294***	0.0351	0.0263**	0.0277***	0.0289***
	(0.00967)	(0.0138)	(0.0140)	(0.0103)	(0.0349)	(0.0121)	(0.00889)	(0.00977)
Log(trade)	0.0107	0.0194	0.0202	0.0104	0.0102	0.0625	0.00431	0.00611
	(0.0155)	(0.0203)	(0.0205)	(0.0158)	(0.0176)	(0.135)	(0.0158)	(0.0151)
Log(agriculture)	-0.0453***	-0.0473***	-0.0481***	-0.0473***	-0.0483***	-0.0471***	-0.00903	-0.0453***
	(0.0121)	(0.0172)	(0.0175)	(0.0133)	(0.0136)	(0.0142)	(0.0705)	(0.0127)
Log(resources rents)	-0.0178***	-0.0179***	-0.0179***	-0.0172***	-0.0176***	-0.0179***	-0.0142**	-0.0275***
	(0.00446)	(0.00544)	(0.00548)	(0.00435)	(0.00461)	(0.00466)	(0.00632)	(0.00691)
Log(gdp capita)*vat adoption					-0.0692			
					(0.0467)			
Log(trade)*vat adoption						-0.0769		
						(0.100)		
Log(agriculture)*vat adoption							0.0695	
							(0.0522)	
Log(resources rents)*vat adoption								0.0153
								(0.0264)
Constant	-0.188							
	(0.120)							
Observations	2,755	2,755	2,755	2,755	2,755	2,755	2,755	2,755
R-squared	0.013							
Number of country_code	96	96	96	96	96	96	96	96
Wald test of exogeneity				0.5442	0.4365	0.5668	0.6618	0.5228

Robust standard errors in parentheses

***p<0.01, ** p<0.05, * p<0.1

Table 15: Allowing for 3 years interval bounds (assumption 2 and 3 of condition 2).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Linear probability	Logit	Probit	IV probit	IV probit	IV probit	IV probit	IV probit
VARIABLES	tax_transition(3)	tax_transition(3)	tax_transition(3)	tax_transition(3)	tax_transition(3)	tax_transition(3)	tax_transition(3)	tax_transition(3)
Vat adoption	0.0548***	0.0599**	0.0593**	0.0702**	0.103*	0.130*	0.120	0.1054*
	(0.0195)	(0.0282)	(0.0276)	(0.0326)	(0.0613)	(0.0750)	(0.0735)	(0.0586)
Log(gdp capita)	0.0192*	0.0223	0.0228	0.0186	0.0500	0.0182	0.0210*	0.0195*
	(0.0113)	(0.0158)	(0.0156)	(0.0122)	(0.0391)	(0.0145)	(0.0118)	(0.0117)
Log(trade)	-0.00887	0.00142	0.00108	-0.00966	-0.0169	-0.0183	-0.0145	-0.0159
	(0.0178)	(0.0239)	(0.0239)	(0.0182)	(0.0215)	(0.0213)	(0.0179)	(0.0175)
Log(agriculture)	-0.0454***	-0.0514**	-0.0514**	-0.0476***	-0.0460***	-0.0465***	-0.00644	-0.0461***
	(0.0141)	(0.0208)	(0.0205)	(0.0155)	(0.0164)	(0.0165)	(0.0809)	(0.0149)
Log(resources rents)	-0.0208***	-0.0217***	-0.0217***	-0.0217***	-0.0219***	-0.0214***	-0.0193***	-0.0399***
	(0.00483)	(0.00748)	(0.00748)	(0.00496)	(0.00516)	(0.00500)	(0.00634)	(0.00818)
Log(gdp capita)*vat adoption					-0.0422			
					(0.0557)			
Log(trade)*vat adoption						0.0325		
						(0.0209)		
Log(agriculture)*vat adoption							0.0714	
							(0.102)	
Log(resources rents)*vat adoption								0.0265**
								(0.0120)
Constant	0.0404							
	(0.142)							
Observations	2,755	2,755	2,755	2,755	2,755	2,755	2,755	2,755
R-squared	0.011							
Number of country_code	96	96	96	96	96	96	96	96
Wald test of exogeneity				0.6047	0.4065	0.5668	0.6618	0.5820

Robust standard errors in parentheses

***p<0.01, ** p<0.05, * p<0.1

Table 16: Duration model of tax transition

	(1)	(2)	(3)	(4)	(5)	(6)
	Tobit	IV_Tobit	IV_Tobit	IV_Tobit	IV_Tobit	IV_Tobit
VARIABLES	tax_transition(4)	tax_transition(4)	tax_transition(4)	tax_transition(4)	tax_transition(4)	tax_transition(4)
Vat adoption	1.401***	1.964***	2.00*	5.17*	5.398	1.712***
	(0.228)	(0.329)	(1.122)	(2.72)	(4.115)	(0.398)
Log(gdp capita)	0.416**	0.230**	1.231***	0.108	0.228*	0.231**
	(0.199)	(0.108)	(0.476)	(0.167)	(0.135)	(0.103)
Log(trade)	0.602**	-0.156	-0.407*	3.439*	-0.109	-0.185
	(0.267)	(0.162)	(0.240)	(1.933)	(0.200)	(0.155)
Log(agriculture)	0.298	0.375***	0.330**	0.266	1.168	0.364***
	(0.236)	(0.138)	(0.164)	(0.190)	(1.153)	(0.131)
Log(resources rents)	-0.177**	-0.224***	-0.255***	-0.235***	-0.272***	-0.318***
	(0.0741)	(0.0448)	(0.0553)	(0.0605)	(0.0836)	(0.0611)
Log(gdp capita)*vat adoption			-1.350			
			(0.870)			
Log(trade)*vat adoption				-2.452		
				(1.946)		
Log(agriculture)*vat adoption					-1.014	
					(1.489)	
Log(resources rents)*vat adoption						0.137
						(0.0851)
Observations	2,755	2,755	2,755	2,755	2,755	2,755
Number of country code	96	96	96	96	96	96
Wald test of exogeneity		0.1747	0.1451	0.1325	0.1473	0.1758

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 17: Investigating for asymmetries

Negative				Positive		
	(1)	(2)	(3)	(4)	(5)	(6)
	Fixed effect	Random effect	IV	Fixed effect	Random effect	IV
VARIABLES	Δvat	Δvat	Δvat	Δvat	Δvat	Δvat
Δtrade tax(-)	-0.0360*	-0.0426**	-0.0820*			
	(0.0209)	(0.0211)	(0.0470)			
Δlog(gdp capita)	0.915**	0.776**	0.361**	0.0733	0.0761	0.0330
	(0.391)	(0.360)	(0.136)	(0.506)	(0.524)	(0.206)
Δtrade	0.00480*	0.00470*	0.00180	0.000115	0.00110	-0.00403
	(0.00256)	(0.00249)	(0.0104)	(0.00297)	(0.00298)	(0.00798)
Δagriculture	-0.00957	-0.00887	-0.00681	-0.00848	-0.0126	-0.0190
	(0.0100)	(0.00984)	(0.0267)	(0.0111)	(0.0112)	(0.0197)
Δresources rents	-0.0124**	-0.0136**	-0.0160	-0.00491	-0.00829	-0.00698
	(0.00620)	(0.00614)	(0.0596)	(0.00779)	(0.00742)	(0.0151)
Δtrade tax(+)				0.0918	0.0577	0.0641
				(0.0766)	(0.0643)	(0.0646)
Constant	-0.0204	-0.0204		0.125***	0.137***	
	(0.0340)	(0.0295)		(0.0317)	(0.0300)	
Observations	1,505	1,505	810	1,279	1,279	583
R-squared	0.014		0.375	0.005		0.253
Number of country_code	96	96	94	96	96	89
Hansen P-value			0.5793			0.6766

Robust standard errors in parentheses

***p<0.01, ** p<0.05, * p<0.1

Negative				Positive		
	(1)	(2)	(3)	(4)	(5)	(6)
	Fixed effect	Random effect	IV	Fixed effect	Random effect	IV
VARIABLES	Δexcises	Δexcises	Δexcises	Δexcises	Δexcises	Δexcises
Δtrade tax(-)	0.0328	0.0169	0.0725			
	(0.0350)	(0.0294)	(0.0478)			
Δlog(gdp capita)	0.232	0.120	0.770	0.214	0.230	0.907
	(0.333)	(0.329)	(0.469)	(0.478)	(0.448)	(0.760)
Δtrade	5.67e-05	9.41e-05	-1.72e-06	-0.00266	-0.00231	-0.00840**
	(0.00101)	(0.00102)	(0.00368)	(0.00201)	(0.00184)	(0.00380)
Δagriculture	0.000819	0.000872	0.0119	0.00736	0.00450	0.0135
	(0.00585)	(0.00554)	(0.0133)	(0.00647)	(0.00585)	(0.0131)
Δresources rents	-0.00232	-0.000786	0.000629	0.00226	0.00293	0.00900
	(0.00400)	(0.00364)	(0.0244)	(0.00696)	(0.00631)	(0.0148)
Δtrade tax(+)				0.00653	0.0141	0.0190
				(0.0426)	(0.0359)	(0.0441)
Constant	-0.00484	-0.00920		0.00492	0.00649	
	(0.0149)	(0.0224)		(0.0186)	(0.0188)	
Observations	1,505	1,505	810	1,279	1,279	583
R-squared	0.002		0.498	0.002		0.207
Number of country_code	96	96	94	96	96	89
Hansen P-value			0.6464			0.8924

Robust standard errors in parentheses

***p<0.01, ** p<0.05, * p<0.1

Conclusion

This paper investigates first wave tax transition in developing countries. Our empirical investigation reveals that, the adoption of VAT was by far an important factor that help developing countries succeeding tax transition. We find that, this effect is robust for African and Asian countries, but not for LAC countries, even if in terms of compensation ratio, LAC countries are by far the ones, that have the greatest compensation ratio of their trade tax revenue losses with VAT. We explain this finding, by the fact that, VAT positive revenue efforts in LAC countries is offset by reduced revenue efforts from other taxes that leads VAT ineffective in their transition process. African and Asian countries even if they succeed tax transition with VAT, have the lowest compensation ratio of their trade tax revenue, only about half. For African countries the major concern of their VAT systems, is the multiplicity of derogatory regimes, that weakens the return of their VAT. In such context, they must carry out an assessment of their VAT gap, and find alternative instrument such as subsidies, to deal with poverty, if they want to offset more their trade tax revenues with VAT. Asian countries on their side, must reduce inter and intrastates rate dispersion and move to a single VAT rate that can enable them to undermine VAT management costs related to goods and services categorizations and raise more VAT revenue. Finally addressing the transition process by asymmetries, we find that transition is not of a high quality, in the sense that, VAT and excises revenue collections are not increasing the period over which they face an increase in trade tax. We suspect a compliance gap in mobilizing VAT and excises over these periods. Overall, our results suggest to take with closer attention VAT and excises as powerful performant first wave tax transition tools in developing countries.

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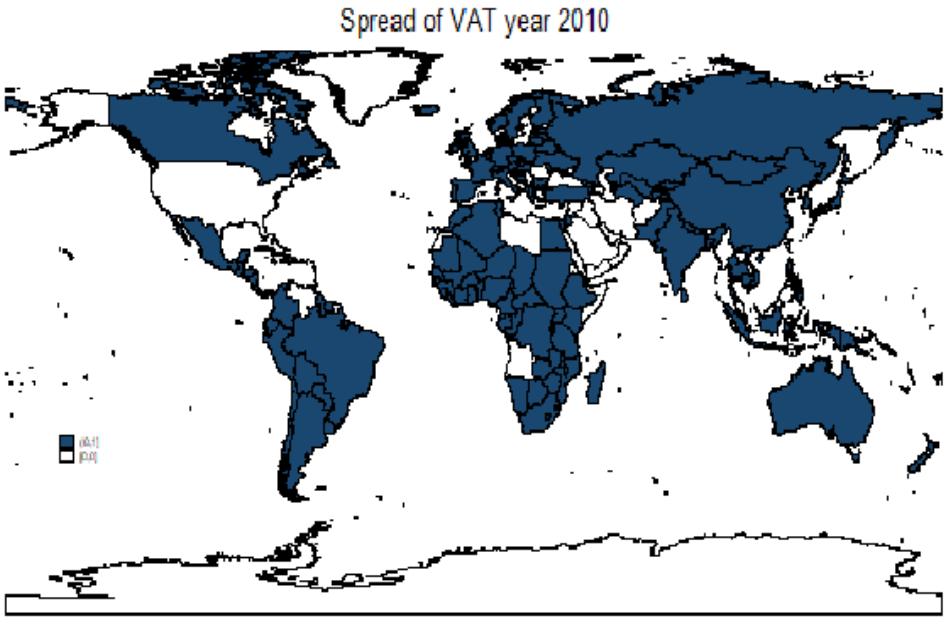
Appendix 1 : Spread of VAT, year 2010



Source : Author with IMF data

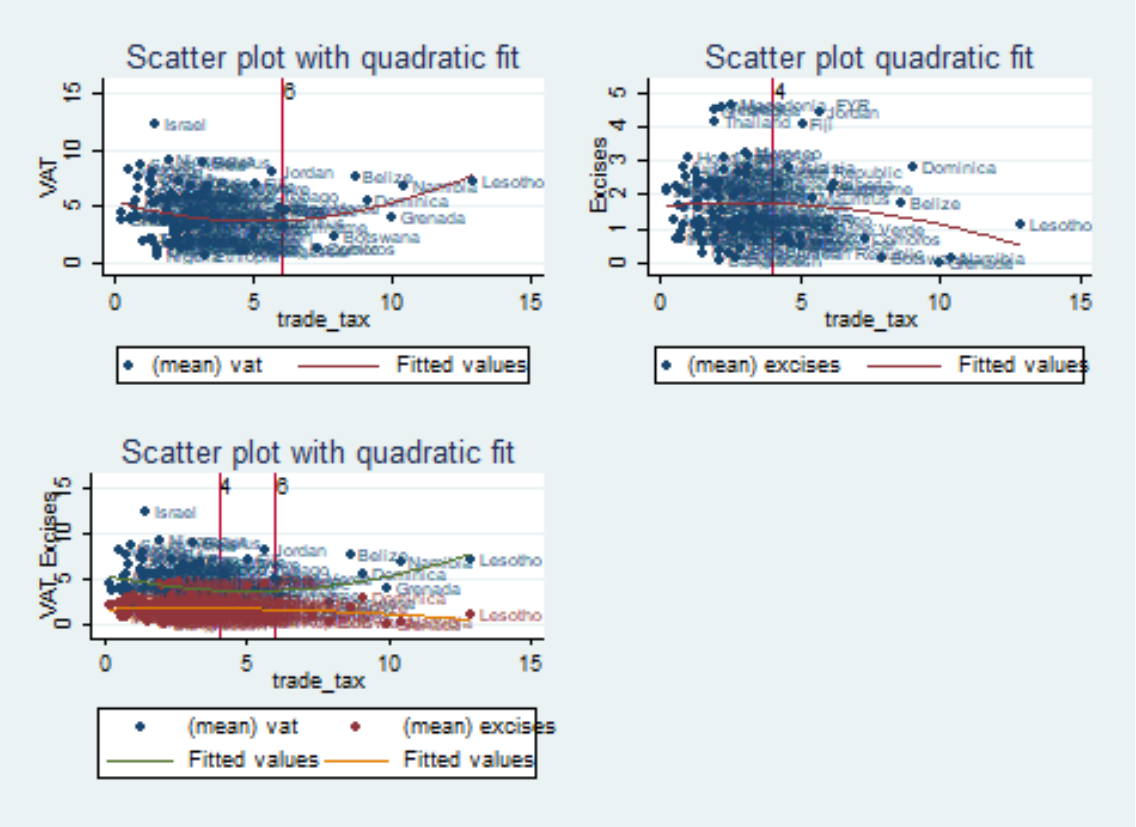
Appendix 2 : List of countries and VAT adoption date

Country	VAT adoption	Country	VAT adoption	Country	VAT adoption	Country	VAT adoption
Albania	1996	Ghana	1998	Niger	1986	El Salvador	1992
Argentina	1975	Guinea	1996	Nigeria	1994	Guyana	2007
Arménia	1992	Guatemala	1983	Nepal	1997	Colombia	1975
Azerbaijan	1993	Honduras	1976	Pakistan	1990	Ecuador	1970
Burundi	2009	Haiti	1982	Panama	1977	Nicaragua	1975
Benin	1991	Iran. Rep.	1980	Peru	1973	Algeria	1992
Burkina Faso	1993	Jamaica	1991	Philippines	1988	Botswana	2002
Bangladesh	1991	Jordan	2001	Rwanda	2001	Gabon	1995
Belarus	1992	Kenya	1990	Senegal	1980	Dominica	2006
Belize	1996	Cambodia	1999	Sierra Leone	2010	Trinidad and Tobago	1990
Bolivia	1973	Lao PDR	1994	Chad	2000	Indonesia	1985
Bhutan	1982	Liberia	2009	Togo	1995	Inde	2005
RCA	2001	Sri Lanka	1998	Thailand	1992	Korea. Rep.	1977
Chile	1975	Lesotho	2003	Tunisia	1988	Singapore	1994
Cote d'Ivoire	1960	Morocco	1986	Turkey	1985	Mongolia	1998
Cameroon	1999	Madagascar	1994	Tanzania	1998	Tonga	2005
Congo. Rep.	1997	Macedonia.	2000	Uganda	1996	Comoros	2011
Costa Rica	1975	Mali	1991	Uruguay	1968	Cape Verde	2004
Cyprus	1992	Mozambique	1999	Venezuela.	1993	Djibouti	2009
Dominican R.	1983	Mauritania	1995	Vietnam	1999	Guinea-Bissau	2001
Egypt. Rep.	1991	Mauritius	1998	South Africa	1991	Grenada	2010
Ethiopia	2003	Malawi	1989	Zimbabwe	2004	Israel	1976
Fiji	1992	Malaysia	1980	Mexique	1980	Kazakhstan	1992
Georgia	1992	Namibia	2000	Paraguay	1993	Suriname	1999

Appendix 3 : Descriptives statistics

Variables	Obs	Mean	Std.dev	Min	Max	1st Quartile	Median	3rd Quartile
Tax_transition	2880	.3347222	.4719752	0	1	0	0	1
Vat_adoption	2880	.6878472	.4634523	0	1	0	1	1
Gdp_capita	2880	4854.449	8087.36	115.4357	53798.36	749.687	2152.502	4924.274
Trade	2880	74.66151	45.50588	9.105691	441.6038	46.61747	64.63966	91.39772
Agriculture	2880	20.10595	14.94634	.0354089	93.97742	8.531352	15.81261	30.21487
Resources_rents	2880	7.614617	9.873775	0	82.58936	1.021049	4.037945	10.24256
Trade_tax	2880	2.837582	2.563569	0	14.98103	1.096328	2.098347	3.662323
Vat	2880	4.651655	3.010118	0	18.46122	2.246144	4.456959	6.605958
Excises	2880	1.720421	1.443984	0.1594086	21.9	.7311496	1.491249	2.409255

Appendix 4 : Scatter plot



Appendix 4

To estimate tax potential we run an auxiliary regression of tax revenue on structural factors that determine tax revenue , namely income per capita, the level of trade openness, the sectoral composition of the economy by adding the ratio of agriculture value added to GDP, and finally their dependence on natural resource sector. Specifically we estimate the following regression

$$Tax\_revenue_{it} = \beta_0 + \beta_1 * Gdp\_capita_{it-1} + \beta_2 * Trade\_openness_{it} + \beta_3 * Agriculture\_value\_added_{it} +$$

$$\beta_4 * Resource\_rents_{it} + \mu_i + \xi_{it} (4)$$

The predicted tax revenue from this regression out of any tax policy considerations are country's tax potential. Tax efforts that take into account the effectiveness of tax policy measures, leads to a deviation of tax revenue from its potential. Thus, let's call the predicted value of tax revenue from this model: $\widehat{Tax\_revenue}_{it}$.

Tax effort is the difference between tax revenue and tax potential and it is due to the tax system and tax policy of countries. If it is positive, countries have revenue over their potential and in the case it is negative they do not approach yet their potential of revenue due to ineffective tax policies.

$$Tax\_effort_{it} = Tax\_revenue_{it} - \widehat{Tax\_revenue}_{it} \quad (5)$$

The advantage is that tax potential is endogenously determined in our model and can reflect properly each country's norm of tax revenue.