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Four Essays on Tax Transition Reform in Developing Countries

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0.3 Résumé

Ces dernières années, la plupart des pays en développement sont confrontés à la nécessité de concilier deux impératifs : d'une part, une demande sociale forte qui nécessite un besoin de ressources publiques supplémentaires, et d'autre part le désarmement tarifaire consécutif aux politiques d'ouverture commerciale, qui les prive de la majeure partie de leurs recettes budgétaires. D'où l'impérieuse nécessité pour ces pays d'assurer une transition dans la structure de leur prélèvement public c'est à dire de transférer la pression fiscale du commerce extérieur vers la fiscalité domestique. Cette thèse s'intéresse à cette problématique et vise à étudier les conditions de réussite d'un tel phénomène dans les pays en développement au travers de quatre essais empiriques.

Le premier essai concerne le rôle de la TVA et des droits d'accises dans une première vague de transition. La TVA étant un impôt neutre et à très large assiette fiscale, cette dernière a été suggérée comme outil majeur pour réussir le transfert des ressources publiques du cordon douanier vers la fiscalité domestique et en complémentarité avec les droits d'accises. Nos investigations empiriques soutiennent cette assertion théorique et montrent que le couple TVA-accise joue bien ce rôle de substitut aux recettes de porte en quasi baisse suite au démantèlement tarifaire dans les pays. Néanmoins le rôle d'appui de la TVA et des droits d'accises est limité à partir d'un certain seuil de baisse des recettes de porte, qui traduit aussi le fait que le potentiel de mobilisation fiscale par la TVA dans ces pays est limité et qu'il faudra s'en préoccuper.

Dans le second essai nous analysons la transition de seconde génération basée sur les impôts directs (impôts sur les revenus et impôts fonciers). Nous trouvons que les impôts directs sont des outils pauvres de transition fiscale dans les pays en développement. Pourtant nous trouvons que le développement financier est un médiateur certain et incontestable à une politique de transition fiscale de seconde génération basée sur les impôts directs, car permettant de recouper l'information sur les revenus des contribuables et de générer des traces documentaires à l'administration fiscale, qui permettent d'envisager une mise à fiscalisation des contribuables, gage de recettes fiscales directes supplémentaires dans les pays.

Dans le troisième essai, nous nous intéressons à l'effet de la mise en place d'une réforme de transition fiscale sur l'efficience dans la collecte des recettes en menant une étude de cas pour l'union économique et monétaire ouest africaine (UEMOA). Nos résultats supportent l'affirmative, en ce sens que la réforme accroit globalement une mobilisation efficiente des recettes dans la zone UEMOA. Cette efficience entrainerait par ailleurs avec elle une amélioration du climat des affaires dans la zone, suite à la mise en place de cette réforme.

Enfin nous terminons cette thèse par un quatrième essai qui interroge quand à lui les impacts distributifs et de pauvreté d'une réforme de transition fiscale basée sur la TVA. Quoique les résultats montrent une incidence régressive de la réforme sur le revenu des ménages, une redistribution par la dépense aurait le mérite d'atténuer l'incidence sociale de cette stratégie de réforme sur le revenu des contribuables.

Mots clés

Transition fiscale, TVA, Accises, Pays en développement, ,Taxes sur le commerce extérieur, Impôt sur le revenu, Impôt sur les sociétés, Impôt foncier, Fiscalité, Potentiel fiscal, Effort fiscal, Exonérations, Administration fiscale, Coordination fiscale, Harmonisation, Climat des affaires, Pauvreté, Inégalités, Reforme fiscale, Développement financier, Internet, Analyse des frontières stochastiques, Efficience, Contrôle Synthétique, Scores de Propension, modèle 2SLS-IV, GMM, Probit et Logit, Équilibre général calculable, Micro-simulation.

Summary

During recent years, most developing countries have been faced with the need to reconcile two imperatives: on the one hand, a strong social demand that requires additional public resources, and on the other, tariff dismantling following trade opening policies, which deprives them from their major budgetary revenues. Hence, it urges for these countries to ensure a transition in the structure of their public revenues, i.e. to transfer the fiscal pressure from international trade to domestic taxation. This thesis focuses on this issue and aims to study the conditions for succeeding such transition through four empirical essays.

The first essay concerns the role of value-added tax (VAT) and excise duties in a first wave of transition. Since VAT is a neutral tax with a very broad tax base, it has been suggested to countries as a major tool for successfully transferring public resources from border taxes to domestic taxation, and to complement the VAT effect with excise duties taxation. Our empirical investigations support this theoretical assertion and show that the pair VAT-excise does play a meaningful role as a substitute for border taxes, which have almost decreased following tariffs dismantling in developing countries. Nevertheless, the supporting role of VAT and excise duties is limited above a certain threshold of decline in border taxes, which also reflects the fact that the potential for tax revenue mobilization by VAT and excises is limited in these countries and deserves close attention.

In the second essay, we analyze the second generation tax transition scheme based on direct taxes (incomes and property taxes). We find that direct taxes are not operational for tax transition in developing countries. However, we find that financial development is an undeniable mediator for a successful second wave tax transition reform based on direct taxes. Financial development would allow to recoup informations on taxpayers' incomes and produce paper trails for tax administrations. This would help enforce incomes taxes and secure additional direct tax revenues in this transition process.

In the third essay, we examine the effect of the implementation of a tax transition reform on the efficiency of revenue collection by conducting a case study for the West African Economic and Monetary Union (WAEMU). Our results support the affirmative, in the sense that the reform increases overall revenue collection efficiency in the WAEMU zone. This efficiency would also lead to an improvement in tax-oriented business climate in the zone, following the implementation of the reform.

Finally, we conclude this thesis with a last essay that examines the distributional and poverty impacts of VAT-based tax transition reform for the case of Togo. Although the results show a regressive impact of the reform on households' income, a redistribution through spending would have the merit of mitigating the social incidence of the reform on households'income at this country level.

Keywords

Tax transition, VAT, Excise, Developing countries, ,Trade taxes, Income tax, Corporate tax, Property tax, Taxation, Tax potential, Tax effort, Exemptions, Tax administration, Tax co-ordination, Harmonization, Business climate, Poverty, Inequality, Tax reform, Financial development, Internet, Stochastic frontier analysis, Efficiency, Synthetic control, Propensity scores, 2SLS-IV model, GMM, Probit and Logit, Computable general equilibrium, Micro-simulation.

Contents

General introduction

During recent decades, most developing countries, concerned with years of low economic growth and macroeconomic imbalances, moved toward more liberal economic policies, particularly in the context of structural adjustment programs that have followed a wave of economic difficulties. One of the orientations of structural policies has been a considerable shift towards more liberal trade regimes by many developing countries as part of recommended policy of the World Trade Organization (WTO), the World Bank (WB), and International Monetary Fund (Jones, Morrissey, & Nelson, 2011a). It is acknowledged that there are substantial gains from trade that result from trade liberalization, and a widespread trade reform in the mid-1980s has been a matter of concern in these countries. A liberal trade regime is an important factor for encouraging economic growth and efficient resource allocation. The case for open trade policies and consequent resource allocation improvements and medium-term growth prospects are well known and documented by a large body of theoretical and empirical literature (Barro, Mankiw, & Sala-i Martin, 1995; Sachs et al., 1995 ;Rodriguez & Rodrik, 2000 Frankel & Romer, 1999; Brückner & Lederman, 2012).

Box 1: Trade and growth

The economic rationale for trade policy reform is based on the improved efficiency of resource allocation and enhanced growth prospects. An open trade regime expands trade and investment options and allows countries to specialize and export products in which they have a comparative advantage.

Trade barriers to imports result in higher prices for imported goods and cause inefficiency as consumers shift to higher-cost domestic substitutes and give up consumption of products they would otherwise prefer.

Import barriers also create an anti-export bias by increasing costs for exporters, as import-competing industries tend to divert workers and capital away from potential exporters or other potentially more efficient economic activities.

The efficiency benefits of an open trade policy also apply to economic growth. In common with other economic distortions, trade policy distortions shift an economy to a less efficient mix of investment, production, and consumption. They create incentives to produce and invest in goods for which the economy's rate of return is below the rate of return for the individual enterprise. These distortions depress economic growth prospects and their removal therefore improves growth prospects. Indeed, it is even possible in a distorted trade regime that new investment or increases in other factor supplies can reduce national income thus depleting economic growth.

The empirical literature on trade and growth confirms the theoretical case for open trade policies namely, that countries with open trade policies grow faster than countries that are more inward oriented and also new developments in the theory of economic growth such as endogenous growth theory highlighted dynamic gains from trade liberalization (Wacziarg, 2001; Nordås et al., 2006; Rutherford & Tarr, 2002).

Instruments used to liberalize trade mainly consist in removing barriers to exports and quantitative restrictions on imports and other non-trade barriers, reducing tariff dispersions through introducing low and relatively uniform tariff rates. Measures to reform import tariffs include reductions in the maximum and higher tariffs and in the number of tariff bands; conversion of specific tariffs into ad valorem rates; consolidation of other import taxes into a single rate; reduction or elimination of tariff exemptions for individuals and firms, all that distorted trade (Sharer & Sorsa, 1998).

The revenue side effect of trade liberalization

While trade liberalization should trigger a dynamic and inclusive growth that should in turn cross the lines of tax revenue mobilization, the experiences of some or most developing countries have been disappointing. It is clear that on the revenue side, liberalization has not been accompanied by increased tax revenue mobilization. This could be explained by two facts: first, the growth effect of trade liberalization was probably not strong enough, and its translation into tax revenue mobilization has also been attenuated by rigidities in the tax system of developing countries (informality, sizeable part of agricultural sector, low diversification of economic activities). Second, the direct effect of tariff cuts and export taxes removal, lowered trade tax revenues and outweighed the indirect pass-through effect of economic growth into public revenue. Tariff disarmament has deprived countries of a main source of revenues, as tariff accounted for main more than half of the public revenues of developing countries. Finally, this effect occurs because the supposed tax base effect of tariff disarmament and export taxes removal (response in terms of imports and exports performance), did not materialize to counter the effect of decreased tariff rates and export taxes elimination.

Box 2: Trade liberalization and tax revenue

When faced with the benefits of liberalization, the question has been "whether countries that rely heavily on international trade tax revenues as a primary source of government revenue" benefit from liberalization. The relationship between trade liberalization and tax revenue is therefore a question of great practical importance. On the one hand, it has been argued that trade liberalization is likely to lead to a considerable decrease in international trade tax revenues through the reduction of tariffs, especially in developing countries. The fiscal downside and fiscal costs of lowering tariff is serious for government relying on trade tax revenues as a primary source. But as pointed out by Greenaway et al. (1993), there is a wide range of possible outcomes of trade liberalization in terms of revenue, depending on initial conditions, the components of the reform package, the effects of changes in tariff rates, changes in the import and export tax bases (volume responses). And based on the trade regime that is liberalized, Bevan (1995) demonstrates that removal of quantitative restrictions are budget improving. And according to this author, the response of revenues also depends on the sequencing in the liberalization process. If categories of economic activities that are relatively easy to tax, are likely to expand in the liberalization process, trade liberalization may not undermine tax revenue (Bevan, 1995). Trade liberalizations accompanied by reforms in customs and tax administrations (simplification of custom procedures) are also revenue improving (Gropp et al., 1999).

The results around tax revenue and trade liberalization did not converge to a global conclusion. As an indirect effect, Agbeyegbe et al. (2004) also found for example that currency appreciation and higher inflation for example, showed some linkage to lower tax revenues during liberalization periods.

Countries collect taxes in different ways. Taxes on income and profits, taxes on goods and services, and international trade taxes, each with its own ease of collection or not. Tariffs are easier to collect than domestic taxes due to low administrative and collection costs. And besides, it is not clear that the effect of trade liberalization on income taxes may be strong in countries with a sizeable part of informality and high administrative costs, to dominate the direct downward effect of decline in tariffs following liberalization periods.

Most studies however contend that liberalization have had a fiscal cost to governments because over time, tariff structures move away from restrictive conditions and the share of trade tax receipts in total tax declines (Khattry & Rao, 2002; Cagé & Gadenne, 2017; Baunsgaard & Keen, 2005).

The genesis of tax transition.

As a result of liberalization policies and in order to mitigate the loss of revenue from international trade and strengthen the level of public revenues, economists recommend to stimulate domestic direct and indirect tax revenue mobilization, primarily by increasing goods and services taxes especially value-added and excise taxes, through a domestic tax reform. By shifting revenue sources from the international trade to broad-based domestic taxes, economists advocate that the negative impact of trade liberalization can be offset by domestic sources of taxation. This phenomenon is often called in the tax literature "tax transition" or precisely "tax-tariff reform". International financial institutions suggested developing countries to replace the foregone revenue from trade by revenue from domestic sources (see Baunsgaard & Keen, 2005; Waglé, 2011; Crivelli, de Mooij, & Keen, 2016; Michael, Hatzipanayotou, & Miller, 1993; Keen & Ligthart, 2002a; Hatzipanayotou, Michael, & Miller, 1994). This reflects the concept of tax transition in developing countries under a weak hypothesis. However, Chambas (2005b) develops the concept of tax transition under a much stronger hypothesis. On the stronger hypothesis, tax transition adds additional conditions that consist in reducing the social cost of public revenues, transforming progressively the tax system (equity, transparency, liability and tax morale) for maintaining an appropriate level of overall tax revenue in a dynamic attempt to preserve revenue (Chambas, 2005b).

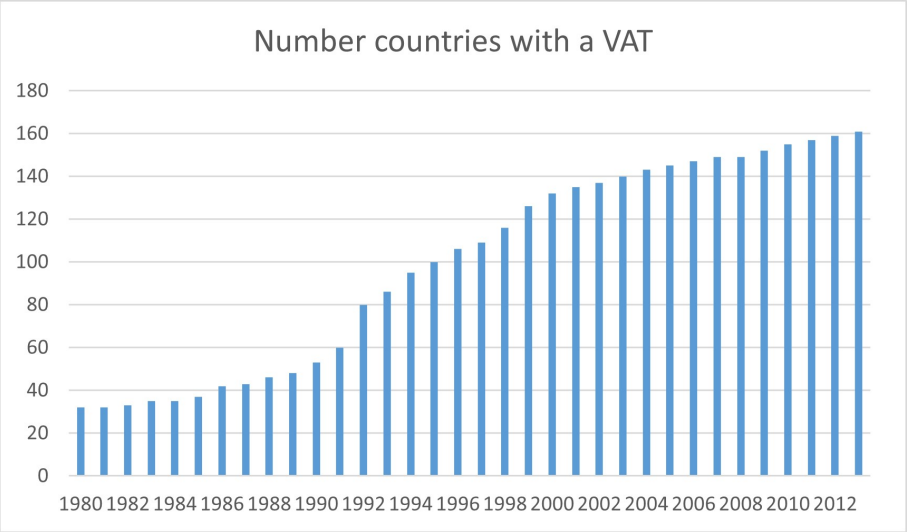
Whatever the way of defining it (weak or stronger hypothesis), it was suggested to countries in the first wave of tax transition reform agenda, to set up an appropriate value-added tax (VAT) and modernize excise regimes in order to allow them to offset trade tax revenue losses with domestic indirect taxes (Chambas, 2005c; Michael et al., 1993; Hatzipanayotou et al., 1994; Abe, 1995; Keen & Ligthart, 2002a; Naito, 2006; Keen, 2008). And following that first wave of reform, they must prepare the ground for a second-generation tax transition reform based on direct taxes Chambas (2005b) and also modernize their revenue collection administration (Bodin, 2012).

The adoption of value-added tax (VAT) in developing countries.

The adoption of the VAT has been the centerpiece of tax transition reforms in developing countries [1]. Between the 1980s and 2010s, the number of countries that have implemented VAT has exploded (from 30 countries in the 1980s to 120 in the 2000s and above 150 in 2013).

[1]Some countries however, had VAT before tax transition reforms. Côte d'Ivoire and Senegal for example, had VAT since the 1960s and 1980s and used it for their tax transition reform afterwards.

Graph 1 Number of countries with VAT 1980-2013



Source: Author with IMF data.

And indeed, VAT is a broad-based consumption tax. It is also neutral for producers, through the deductibility process on intermediate goods consumption, and much harder to avoid, as the tax is collected at all intermediate steps during the production process of a finished good. It has proven efficiency to collect a great deal of revenue Keen and Lockwood (2010) and is theoretically less distorting than border taxes. 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 (Ebrill, 2001). Finally VAT can be implemented with ease in many developing countries (Chambas, 2005c; R. Bird & Gendron, 2007). The adoption of a VAT makes it easier to raise revenue as characterized by Keen and Lockwood (2010) as a money machine, and in that sense, also improves efficiency in the overall tax system (Ebrill, 2001).

Box 3: A note on VAT

The main characteristics of value-added tax are that it is a broad-based tax levied at several stages of production, with input taxes deducted from output taxes, which is particularly important. In other words, while sellers are required to charge tax on all their sales, they can also claim a credit for the taxes they had to pay on their inputs. The advantage of such a system is that revenues are guaranteed because they are collected throughout the production process and without distorting production decisions, as a sale tax does.

Suppose, for example, that firm A sells its output (assumed, for simplicity, to be produced without material inputs) at a price of $100 (excluding taxes) to firm B, which in turn sells its output for $400 (again excluding taxes) to final consumers.

Now assume that there is a VAT rate of 10%. Company A will then charge $110 to company B, paying $10 in tax to the government. Firm B will charge final consumers $440, remitting tax of $30: output tax of $40 less a credit for the $10 of tax charged on its inputs. The government thus collects a total of $40 in revenue.

In its economic effects, the tax is thus equivalent to a 10 percent tax on final sales (there is no tax incentive, in particular, for B to change its production methods or for the two firms to merge), but the method of its collection secures the revenue more effectively.

"Zero-rating" refers to a situation in which the rate of tax applied to sales is zero, through credit is still given for taxes paid on inputs. In this case, the firm will be due a full refund of taxes paid on inputs. In a VAT designed to tax domestic consumption only, exports are zero-rated, meaning that exports leave the country free of any VAT. This is consistent with the "destination principle," which is the international norm: it requires that the total tax paid on a good be determined by the rate levied in the jurisdiction of its final sale with revenue accruing to that jurisdiction. In contrast, the "origin principle" requires that tax be paid at the rate of, and to, the country or countries in which the item is produced rather than consumed.

"Exemption" is quite different to zero-rating in that, while tax is again not charged on outputs, tax paid on inputs cannot be reclaimed. Thus, no refunds are payable. In this case, because tax on intermediate transactions remains unrecovered, production decisions may be affected by the VAT.

Excise duties.

It has been suggested that countries complement VAT revenues by mobilizing excise taxes in the first generation (Chambas, 2005b). Indeed, excise duties concern specific final consumption goods (alcohol, tobacco, cigarette, petroleum, mobile phone, high-powered private vehicle, etc.) likely to generate substantial tax revenues because of the importance of the consumption of the goods concerned, but also low elasticity of consumption of excisable goods to price increases (Cnossen, 2005; Cnossen, 2011a). The reforms undertaken in recent years in relation to excise duties have been the simplification of the excise tax system (rationalization of the number of excises and the number of items), the delimitation of minimum and maximum rates for excisable goods, and the generalization of ad-valorem and composite rates.

Incomes and property taxes.

Incomes and property are more challenging to tax in developing countries. This is because of their inherent narrow tax bases (personal income taxes (PIT), corporate income taxes (CIT)), consequently to the large informal activities and sizeable agricultural sector, that are difficult to tax. Property taxation (PT), is also challenging to implement due to administrative difficulties to enforce this tax. In fact, one approach used to raise direct taxes has been to generalize withholding regimes on them, but for the moment this often concerns wages for PIT, levied on the category of formal jobs in the formal sector (Chambas, 2005b). In order to ensure that direct taxes are fully integrated into a second-generation tax transition concerns, the literature points to the need to reform them, in order to increase their contribution to revenue. These include : low personal and corporate income tax rates to increase compliance, simplification of tax brackets and best design of marginal tax rates to enhance equity, broadening of CIT base by simplifying the depreciation system for corporates V. Tanzi and Zee (2000a), and the use of digital tools for these taxes. For property taxation (PT), digitalization may also help identify properties Kelly (2000), but also a better control of tax evasion in the overall tax system (R. Bird, 2010).

Objective and scope of the thesis.

Objectives of the thesis.

While many studies have laid the groundwork for a tax transition reform in developing countries that would allow them to stabilize their revenue levels by shifting the tax burden from foreign trade to domestic taxation Baunsgaard and Keen (2005); Michael et al. (1993); Keen and Ligthart (2002a); Hatzipanayotou et al. (1994), very few in-depth analyses have actually been done to prove the current state and the art around the reform in developing countries, and to propose ways for successful revenue replacement strategy.

An exception is the paper of Baunsgaard and Keen (2005) that shows in particular 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). According to these authors, low-income countries recovered at best, not more than 30 percent of every dollar lost on international trade (Baunsgaard & Keen, 2005). Chambas (2005c), for its part, suggests a first-generation tax transition reform based on VAT, and a second-generation reform based on direct taxes, when countries would have sufficiently modernized direct taxation to contribute to revenue. But author does not propose any quantitative assessment of the degree of recovery of lost in foreign trade tax revenues by VAT or direct taxes.

This thesis revisits this set of considerations by conducting a much broader investigation of the issue that encompasses a large sample of developing countries and regions, and by proposing tools for successful reform, in order to remove external constraint on government revenues made of foreign trade tax revenues.

Scope of the thesis

The thesis is organized into four chapters: the first two chapters examine the effectiveness of tax transition instruments in developing countries, while the last two chapters question the consequences of this reform in some developing countries.

The first chapter focuses on indirect taxation for the first generation tax transition reform, namely VAT and excises. The main research question is whether VAT and excise duties are fulfilling their role in supporting first-generation fiscal transition in countries. What is the fiscal impact of VAT and excise duties, and to what extent do they compensate for the custom revenue losses of trade liberalization in the countries? Are there heterogeneities between countries in the tax mobilization effort of VAT that would explain different patterns of compensation ratios? Is there a global conformity in VAT tax mobilization that could make it an impartial tax to be trusted?

The second chapter focuses on direct taxes (personal income taxes, corporate income taxes and property taxes). What role do these taxes play in the second generation tax transition purposes? What are the challenges of these taxes and how to accompany them? Is the diversification of economies essential to expand tax bases and mobilize additional direct tax revenues in the next generation tax transition purposes?

The third chapter is concerned with a quasi-experimentation in the WAEMU (West African Economic and Monetary Union) countries. It aims to study the impact of the announcement effect of tax transition reform through the community legislation, on the efficiency of tax revenue collection. The third chapter also aims at testing if the achieved efficiency in mobilizing tax revenues in WAEMU countries following the reform, goes hand in hand with an improvement in tax-oriented doing business at the community level, the number of years where the achieved efficiency in mobilizing tax revenues is obtained, and the channels through which the reform is overall working (tax discipline or tax morale).

Finally, the last chapter is concerned about the distributional and poverty consequences of VAT based tax transition in Togo, and the conditions under which the impact of the concerned reform on households' income, can be mitigated to ensure its sustainability over time.

Part I

TAX TRANSITION INSTRUMENTS IN DEVELOPING COUNTRIES.

Chapter 1

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

Abstract

This paper investigates the role of Value-Added Tax (VAT) and excises in first wave tax transition (movement away from international trade taxes towards domestic revenue collection) of developing countries. Focusing on a sample of 96 developing countries over the period 1985-2013, we investigate whether the adoption of VAT enables developing countries to increase the likelihood of succeeding tax transition. Results indicate that having a VAT, allows developing countries to increase the probability of succeeding tax transition by 12%. 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 for about 52% trade tax revenue losses in developing countries with a U relationship, while this effect holds for excises duties with a U inverted relationship. The study also points out heterogeneities (while VAT adoption 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). While enhancing tax administration fosters the transition process in these countries, the study however suggests taking with closer attention VAT and excises as powerful first wave tax transition tools in developing countries.

JEL code: H20

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

1.1 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, 2014a). 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.

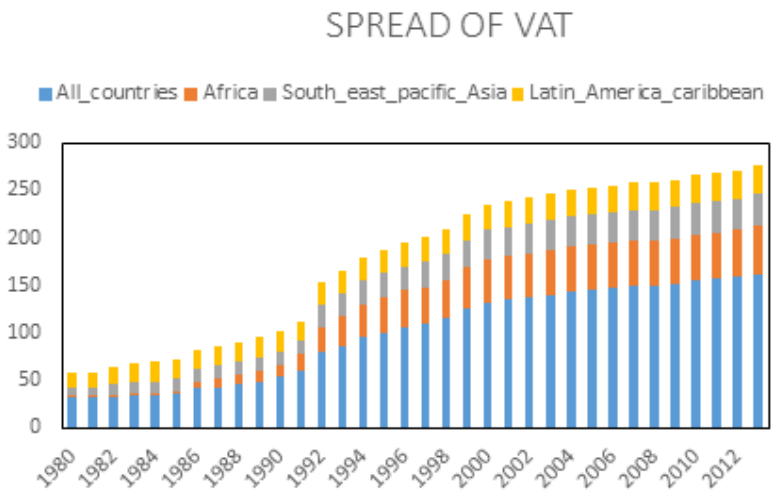
Yet, in developing countries, before trade liberalization, international trade taxes accounted for the most of tax revenues of these countries, allowing them to finance public expenditures (V. Tanzi & Zee, 2000b). Due to trade openness policies, these countries like developed countries, face a sharp 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, 2002b; 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. (2011b), 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, 2005b). Tax transition consists in a move from public revenues, long dominated by international trade taxes, to public revenues levied on domestic 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, 2005c; R. 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 R. Bird (1989) ; R. Bird and Gendron (2007) recognizing resource mobilization constraints on direct taxes of these countries (Chambas, 2005c). Excise duties, levied at high rates on specific goods such as alcohol, tobacco and cigarettes, can also provide

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

significant revenues, most times due to the inelasticity of consumer price to these goods (Bolnick & Haughton, 1998 ; Cnossen, 2011b). 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, undermine VAT revenue performance, and alter tax transition process (Chambas, 2005c).

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

[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

degree to which VAT and excises are offsetting trade tax revenue losses in developing 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.

1.2 Sound concept and attempts of measuring tax transition.

1.2.1 Concept of tax transition

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Tax transition is a concept that covers a multidimensional area of meaning. Yet, in the weak hypothesis, it refers to the balancing role of international trade taxes through increases in domestic revenue (Baunsgaard & Keen, 2010). This substitution effect can occur through indirect taxes (VAT and excises) or through direct taxes (corporate and personal 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 adds additional conditions that consist in reducing the social cost of public revenues, transforming progressively the tax system (equity, transparency, liability and tax morale) for maintaining an appropriate level of overall tax revenue (Chambas, 2005b). This last assumption implies that 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.

1.2.2 Attempts of measuring the concept

1.2.2.1 Initial attempts of measuring the concept

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Measuring tax transition is a daunting task even if by definition transition better covers a qualitative dimension. One aspect 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 C. Ebeke and Ehrhart (2010); C. Ebeke and Ehrhart (2011) confirm the stabilizing effect of VAT, a quantitative manner of measuring the concept is not suitable because transition better covers 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 needs 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 cannot be applied to all countries. Second, they also lack a robust basis and finally, don't consider 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 is 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.

1.2.2.2 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, the 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 cannot suppose a country, succeeding in 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

[3]The detail of computing tax potential is given in section 2.2.3

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 revenue 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.

1.2.2.3 Concept of tax potential and tax effort: a survey of methodological issues

.

Several ways exist to compute tax potential of countries. The primary approach is to run an auxiliary regression of tax revenue on structural factors that determine tax revenue, namely GDP per capita, the level of trade openness, the sectoral composition of the economy by taking into account the ratio of agriculture sector to GDP, and finally the dependence on natural resource sector. Specifically, the following regression is to be estimated by a simple Ordinary Least Square Estimator with countries fixed effect.

$$Tax\_revenue_{it} = \beta_0 + \beta_1 * Gdp\_capita_{it-1} + \beta_2 * Trade\_openness_{it} + \beta_3 * Agriculture\_value\_added_{it} + \beta_4 * Resource\_rents_{it} + \mu_i + \xi_{it} \quad (1.1)$$

The predicted tax revenue from this regression out of any tax policy consideration is country's tax potential. Tax effort that takes 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 implementation.

$$Tax\_effort_{it} = Tax\_revenue_{it} - \widehat{Tax\_revenue_{it}} \quad (1.2)$$

The advantage of the method is that, tax potential is endogenously determined and reflects properly each country's norm of tax revenue. The core of this above methodology is pioneered by (Jørgen R. Lotz, 1967).

Recently the literature on estimating tax effort was packed with more advanced methodological issues particularly the stochastic frontier method. The rationale behind this new methodology is to estimate a frontier of tax revenue that represents countries' tax capacity according to fundamentals (inputs), and to compute inefficiencies to the frontier (score of tax revenue gap). These efficiencies are equivalent to tax effort. Several generations of authors handle with the SFM[4] method in the literature with various interpretations and formulations of the efficiency score. The SFM was first proposed by Aigner, Lovell, and Schmidt (1977) for modelling production and technical efficiency of firms. The production function basically predicts the maximum of output that a firm can reach according to inputs. From a tax revenue perspective, this concept of maximality is interesting in estimating tax capacity and tax effort because it puts a bound on the tax revenue variable (Aigner et al., 1977; Førsund, Lovell, & Schmidt, 1980).
The difference between the SFM and traditional econometric methods broadly relies on the specification of the error term, which can be divided into many parts according to the interested model.
The first generation of SFM models relies on a time invariant technical efficiency from (Schmidt & Sickles, 1984[5] ; Pitt & Lee, 1981; Kumbhakar, 1987; Battese & Coelli, 1988[6]). The model is :

$$logY_{it} = \alpha_0 + f(logX_{it}; \beta) + \xi_{it} \tag{1.3}$$

$$\xi_{it} = vit - \mu_i \tag{1.4}$$

logYit is the logarithm of tax revenue to GDP, logXit is the vector of inputs in logarithm (vector of structural factors that determine countries' tax capacity) ; β is the vector of parameters to be estimated . Note that, the error term in this model is decomposed into two parts: υ_{it} corresponds to the random noise and μ_i is the inefficiency term, which is time-invariant and specific to each country and independently distributed. The function is a logarithmic type. The model is estimated through a maximum likelihood estimator and is considered as fixed in Schmidt and Sickles (1984) and random in (Pitt & Lee, 1981; Kumbhakar, 1987;Battese & Coelli, 1988).

[4]Stochastic frontier method

[5]In Schmidt(1984) the model is estimated through a fixed effect technical efficiency assumption

[6]In Lee (1981) ; Kumbhakar (1987); and Battese and Coelli (1988) they rather used a random effect time-invariant technical efficiency

The second-generation technical efficiency models thanks to Cornwell et al. (1990); Lee and Schmidt (1993); Kumbhakar (1990); Battese and Coelli (1992); Kumbhakar and Wang (2005); Kumbhakar et al. (2014), takes into account time-variant components of technical efficiency by various specifications in the time decay effects [7]. The most popular of the time-varying technical efficiency models is the one of Kumbhakar et al. (2014) that has the particularity that it can distinguish between persistent and time-varying technical efficiency. Basically, time-varying technical efficiency models release the assumption of invariability of the efficiency term over time. A country can improve its tax performance over time through a tax reform for example. Thus, the model allows the error term to be divided into many components : the random noise, countries unobserved heterogeneities which capture time invariant heterogeneities, persistent technical efficiency relating to tax law stability, and time varying technical efficiency due to tax administration. The model is:

$$logY_{it} = \alpha_0 + f(logX_{it}; \beta) + \xi_{it} \tag{1.5}$$

$$\xi_{it} = vit - \mu_{it} \tag{1.6}$$

$$\mu_{it} = \mu_i + \lambda_{it} \tag{1.7}$$

Finally, tax potential in these models is the ratio of actual tax revenues to predicted technical efficiency and tax effort corresponds to the technical efficiency term.

1.3 Tax transition in developing countries: stylized facts

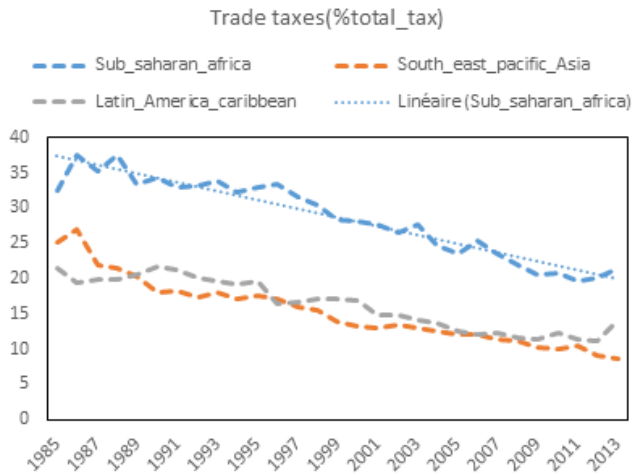
1.3.1 VAT, trade taxes and excises : recent trends

.

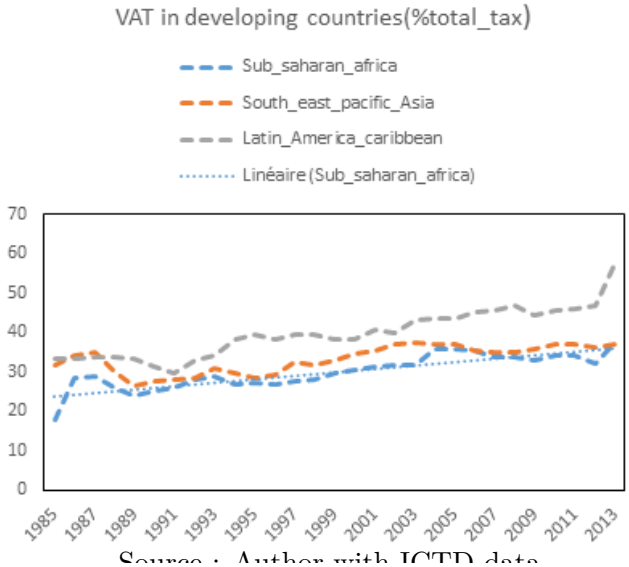
Despite the centrality of the question, it remains tricky to find in the literature, studies that confront data with the view to analyze tax transition. This section provides some basic graphs, in order to look at recent trends in VAT, excises, and trade tax revenues in developing countries, to shed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

[7] For more detail see Kumbhakar (2015), A practitioner's guide to stochastic frontier analysis

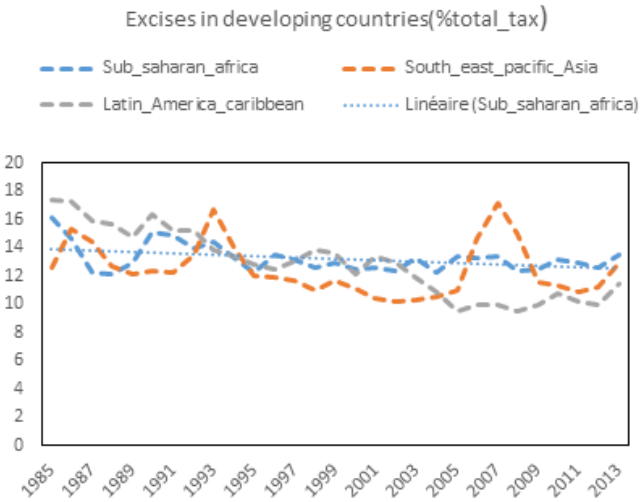
Graph2 : Trade taxes, VAT and excises : recent trends



Source : Author with ICTD data.



Source : Author with ICTD data.



Source : Author with ICTD data.

As it can be observed above, graph 2 shows a transition process occurring by VAT (under the weak hypothesis). Overall, 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 occurring 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 consider 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.

Excises duties however, 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 (2011b) since it can raise about a third of VAT revenue (Chambas, 2005c).

1.3.2 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 1.1: 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 at a rate of 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 the 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 1.2: 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) remained in transition with an increased tax effort (2.11 to 2.59).

1.4 VAT and excises as tax transition tools

1.4.1 VAT as a tax transition tool

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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 targets 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 [8], 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; R. 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, the VAT base becomes narrower (Keen & Mintz, 2004). Thus, considering firms which are below the threshold, they cannot charge VAT on their output, and cannot 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

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

dualism and affects 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 with a 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)[9]. 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, 1996a). 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 a 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 and Haughton (1996a) 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 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 charges VAT to the customer and is no longer entitled to be reimbursed the amount of VAT paid on his purchases (Chambas, 2005c). Compared 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 and Krelove (2005), the impossibility for the local firm selling exempt goods to deduct VAT, restores the cascading effects specific to turnover taxes (Chambas, 2005c). On the other side, if exemption occurs at the 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

[9]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

& 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, the 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 come from two factors : a "policy gap" (multiple rates and exemptions), and a "compliance gap" or imperfect implementation of VAT. For developing and emerging economies, the compliance gap is the most important factor that drives 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, C. Ebeke et al. (2016) investigated whether VAT 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, C. Ebeke and Ehrhart (2010) show that, VAT reduces 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 C. Ebeke and Ehrhart (2011) found that this effect is robust to all developing countries that adopted VAT. Nevertheless, Baunsgaard and Keen (2010) provide controversial findings 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.

1.4.2 Excises as complements 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. Excise can also help discourage alcohol and tobacco consumption due to the fact that it increases significantly consumption prices (Cnossen, 2005). As Ramsey (1927a), 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[10] 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 purposes, the choice between these two 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, 2011b).

1.5 Tax transition in developing countries : Empirical framework

1.5.1 Model specification

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

We present the empirical model that serves 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 and Keen (2010).

Equation 1 : Probability model equation

$$Tax\_transition_{it} = \beta_0 + \beta_1 * vat\_adoption_{it} + \beta_2 * LogX_{it} + \mu_i + \xi_{it} \tag{1.8}$$

Equation 2 : Compensatory effect model

$$Y_{it} = \beta_0 + \beta_1 * trade\_tax_{it} + \beta_2 * trade\_tax_{it}^2 + \beta_3 * X_{it} + \mu_i + \xi_{it} \tag{1.9}$$

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 covers 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 explains their transition process. ξ_{it}, the idiosyncratic error term.

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 nonlinear 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 :

$$\frac{\partial_Y}{\partial_{Trade\_tax}} = 0 \Rightarrow \beta_1 + 2\beta_2 * trade\_tax = 0 \Rightarrow trade\_tax^* = \frac{-\beta_1}{2\beta_2} \tag{1.10}$$

1.5.2 Data and variables

1.5.2.1 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 takes 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.

1.5.2.2 Independent variables

.

Explanatory variables include VAT adoption. This variable comes from the IMF tax policy division database, and takes the value 1 the period over which a country has 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, (iv) agriculture value added to GDP, (v) corruption, and (vi) bureaucracy quality . These variables come from the World Development Indicators (WDI, 2016) except institutional variables that come from International Country Risk Guide (ICRG, 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 improvements in custom procedures. Aizenman and Jinjarak (2009) highlight the fact that trade openness should shift tax revenue from "easy to collect taxes" (tariffs) towards "hard to collect taxes" (value-added and income taxes). Overall, the effects of trade liberalization on tax revenue and later 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 M. 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.

The literature suggests that corruption affects tax revenue by its effect on tax evasion (Attila, Chambas, & Combes, 2009). Indeed, Hindriks et al. (1999) highlight the fact that corruption and tax evasion are closely linked. Corruption undermines tax morale and tends to increase

tax non-compliance. This could have a negative effect on indirect taxes, especially VAT tax revenue. But the effect could be mixed. In a high corrupt environment, the possibility of negotiating frequently bribes between auditors and taxpayers may encourage controllers to increase fraud detection effort because with time, fraud becomes less attractive, and corruption would lead to increased tax revenue.

Finally, incentive reforms in tax administration notably the internal organization of bureaucracies and the organizational structure of tax administration positively affect revenue mobilization. For example countries with sound bureaucracy quality are more efficient in collecting and refunding VAT, while the extent of discretion available to bureaucrats negatively affects VAT revenue mobilization (Mookherjee, 1998).

1.5.3 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), establishes several factors that drive VAT adoption in developing countries. C. Ebeke (2011), uses neighbourhood 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. But we think that the IMF involvement effects on VAT adoption is not strictly exogenous to tax transition since it can directly affect tax potential of countries, a condition considered in computing our transition variable. We rather instrument VAT adoption

with two neighbourhood effect instruments: the share of neighbours that previously adopted VAT before the given country (NeighbourV), and the presence of VAT in neighbouring countries weighted by inverse distance from country in question (DistanceV). As said earlier, both instruments are neighbourhood instruments but have different strengths. While the first reveals the spillovers effect in VAT adoption depending on the frequency of adoption in neighbourhood countries, the second tells something more precisely about the proximity effect in distance not related to the frequency effect (Alavuotunki et al., 2019).

For trade taxes in equation 2, the impact effect of trade liberalization on trade taxes, and further of trade taxes on domestic taxes is conceptually endogenous. First, even if first steps of trade liberalization may follow an exogenous change in trade tax instruments dictated by participation in multilateral negotiations, further steps of the liberalization process consisting in removing prohibitively high tariffs, eliminating quotas and exemptions, consolidating level of tariffs to a more uniform one, and improving custom administrations and procedures are intrinsic to the country and endogenously affect trade tax revenues. Second, the extent to which a country optimally compensates lost of trade tax revenues with domestic taxes depends on the way it is easy or not for this country to collect domestic revenues in the face of tariff cuts, for example. The result is that there would be a simultaneity in the relationship that goes from trade taxes to domestic taxes in our matrix of Y. Intuitively by constraining the way VAT and excise revenues can be raised, collection and compliance costs may indirectly affect further reliance on trade taxes for example. So we need an instrumental variable approach to solve the endogeneity of trade taxes also in equation 2. We rely on the Generalized Method of Moment Estimator framework to solve the endogeneity of trade taxes with lagged internal variables as instruments. So we need to follow moment conditions of Arellano and Bond (1991); and Blundell and Bond (1998) also by adding lagged dependent variables in our equation 2.

1.6 Results

Table 1.3 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 12%, when a country adopts VAT. Hence, if the adoption of VAT allows countries to succeed in their transition process, one might probably suspect that it partly helps compensate for trade tax revenue losses in these countries as a consequence.

Table 1.3: Baseline estimate, probability model, marginal effect

	(1)	(2)	(3)	(4)
	Linear probability	Logit	Probit	IV probit
VARIABLES	tax transition	tax transition	tax transition	tax transition
Vat adoption	0.0923***	0.0978***	0.0941***	0.120***
	(0.0205)	(0.0378)	(0.0363)	(0.0357)
Log(gdp capita)	0.0239*	0.0313	0.0319	0.0224*
	(0.0123)	(0.0232)	(0.0229)	(0.0135)
Log(trade)	-0.0152	0.0116	0.0123	-0.0151
	(0.0189)	(0.0370)	(0.0363)	(0.0195)
Log(agriculture)	0.0544***	0.0719**	0.0714**	0.0573***
	(0.0151)	(0.0293)	(0.0290)	(0.0167)
Log(resource rents)	-0.0248***	-0.0321***	-0.0316***	-0.0262***
	(0.00509)	(0.0105)	(0.0104)	(0.00532)
Corruption	0.00580	-0.000915	-0.00142	0.00735
	(0.00982)	(0.0156)	(0.0153)	(0.0106)
Bureaucracy	0.0118	0.0210	0.0215	0.0124
	(0.0109)	(0.0183)	(0.0180)	(0.0116)
o.neighbors				-
o.distance				-
Constant	-0.00660			
	(0.150)			
Observations	2,755	2,755	2,755	2,755
R-squared	0.022			
Number of country code	96	96	96	96
Wald test of exogeneity				0.4252

Robust standard errors in parentheses

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

Table 1.4 reports the results for the compensatory effect of VAT but also excises. We also made various estimates and based our results on the instrumental variable estimate in column 3 and 6. Our results in column 3 suggest that a decrease of one percentage point of trade tax revenue to GDP, leads to an increase of 0.52 percentage points of VAT. More specifically, the loss of one percentage point of trade tax revenues to GDP, is offset by an increase of 0.52 percentage points of VAT. In other words, developing countries are offsetting 52% of their trade tax revenues with VAT. In the same column, our results suggest that, the effect is nonlinear. Indeed, the positive sign of the square term and the appropriate threshold effect indicates that the compensatory effect holds if and only if the decrease in trade tax revenue does not exceed 5.7 percentage points of GDP (VAT exhibits 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 6, our results suggest that excises are offsetting for revenue losses, once the decrease in trade tax revenue reached 5.5 percentage points of GDP (we find an U inverted relationship between trade tax and excises with a turning point at 5.5 percentage points of GDP). Thus, the study points out a complementarity effect between VAT and excises in the interval of trade tax revenue between [5.5-5.7] points of GDP. Outside this interval of complementarity, VAT still works for revenue losses below 5.5 percentage points of trade tax to GDP with a fifty-two percent to-one ratio. The tight complementary interval might tell something more important that, excises are used in the tax transition process to compensate for trade tax revenue losses once VAT revenue performance just starts to decline.

Table 1.4: Compensatory and complementarity effect between VAT and excises

	(1)	(2)	(3)	(4)	(5)	(6)
	Fixed effect	Random effect	GMM	Fixed effect	Random effect	GMM
VARIABLES	vat	vat	vat	excises	excises	excises
L.vat			0.849***			
			(0.0638)			
L.excises						0.759***
						(0.0531)
Trade tax	-0.273	-0.282	-0.526**	0.0457	0.0449	0.215**
	(0.176)	(0.172)	(0.214)	(0.0648)	(0.0611)	(0.0999)
Gdp_capita	3.12e-05	2.88e-05	-1.52e-05*	-3.03e-05	-1.55e-05	5.07e-06
	(3.23e-05)	(2.65e-05)	(8.72e-06)	(1.83e-05)	(1.06e-05)	(3.65e-06)
Agriculture	-0.0770***	-0.0777***	-0.00712*	-0.00877	-0.0123**	-0.00450***
	(0.0181)	(0.0164)	(0.00427)	(0.00613)	(0.00550)	(0.00172)
Trade	0.00482	0.00473	0.00165	-0.000674	-0.000490	-0.000191
	(0.00455)	(0.00421)	(0.00154)	(0.00149)	(0.00127)	(0.000507)
Resource rents	0.000642	-0.00179	-0.00387	0.00525	0.00179	-0.00505**
	(0.0125)	(0.0125)	(0.00329)	(0.00622)	(0.00611)	(0.00237)
Corruption	-0.185**	-0.184**	0.0563*	-0.00414	0.0214	-0.0114
	(0.0836)	(0.0838)	(0.0292)	(0.0452)	(0.0433)	(0.0149)
Bureaucracy	0.151	0.146	-0.0249	-0.147**	-0.151**	0.00383
	(0.161)	(0.160)	(0.0320)	(0.0685)	(0.0680)	(0.0178)
$Trade\_tax^2$	-0.00470	-0.00195	0.0456**	-0.00429	-0.00496	-0.0192**
	(0.0195)	(0.0190)	(0.0193)	(0.00479)	(0.00463)	(0.00805)
Constant	6.780***	6.821***	1.588***	2.242***	2.205***	0.202
	(0.632)	(0.652)	(0.574)	(0.228)	(0.253)	(0.138)
Observations	2,784	2,784	2,688	2,784	2,784	2,688
R-squared	0.165			0.015		
Number of country code	96	96	96	96	96	96
Ar(2) p-values			0.766			0.391
Hansen p-values			0.339			0.104
Ar(1) p-values			0.000			0.003

Robust standard errors in parentheses

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

1.7 Sensitivity analysis

1.7.1 Is our result robust to sub-sample diversities ?

Our assumption is that tax systems vary across countries and regions of the developing world. For example, while African countries have an emerging VAT mostly with a single VAT rate but with numerous exemptions, Asian countries adopted low VAT rate, substantial rate dispersion and few exempted goods. These trends differ considering Latin American countries that have VAT almost at a 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 1.5 reports results on the sub-group of African countries while estimating equation 1. Results obtained on this table indicate that, VAT adoption effects 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 13.5% when they have VAT. Table 1.6 replicates estimates of equation 2 on the same group of African countries. It indicates in column 3 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 37% 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, erode the VAT tax base and reduce VAT revenue performance. We find a turning point at 6.4 percentage points of trade tax to GDP. This high turning point as compared to the one obtained on total sample just indicates the degree to which these countries are dependent heavily on trade tax revenues. Later on, results on excises in column 6 show that, they are ineffective in offsetting trade tax revenue losses in this region of countries.

In table 1.7, we now 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 33%, also because of VAT. Then VAT appears as an important tool in developing countries that help succeeding transition. This high probability of transition with VAT can be explained first, by the fact that Asian countries almost have VAT at a low rate that brings compliance towards mobilizing VAT revenue, but they are also less dependent on trade tax revenue as compared to

African countries. Second, results that we obtained in next table 1.8 concerning their compensation effect could also help understand this likelihood. Indeed, with this group of countries, we found a linear relationship concerning equation 2 in the VAT offsetting effect, even though the intensity (40%) of compensation is not as far from the one obtained on African countries. The linear relationship made it more likely to succeed tax transition with their adopted VAT, and this linear relationship as said earlier can be explained by their low adopted VAT rate with few exempted goods which is at work in this area of countries, by bringing perhaps more VAT compliance. Finally, results that we obtained with excises duties in column 6 of table 1.8 reinforce the idea that, excises are not effective in both African and Asian countries, and that they remain ineffective in their transition process.

The last check was made on the group of LAC [11] countries. Estimates of equation 1 is presented in table 1.9 and reveal that the results are not robust for this group of countries. VAT is showing an insignificant effect on tax transition for this sub-group of countries. Even if positive, this effect tells 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 has VAT in the model.

Replicating estimates of equation 2 on this sub-group of LAC countries, results in table 1.10 suggest that, LAC countries increased the contribution from VAT, from the moment when the losing limit of trade tax reached 5.6 percentage points of trade tax to GDP. Thus, this paper found heterogeneous effects in the VAT compensation effects across countries and regions. Such heterogeneities haven't been tested in the earlier literature, and we think this paper contributes to the VAT effectiveness literature concerning attitudes of tax administrations in using VAT to mobilize revenue. Finally, we find that excises react to trade tax revenue losses in LAC countries, once the decrease in this tax also reached 5.6 percentage points of trade tax to GDP. As a conclusion, one can suspect that Latin American countries put simultaneously VAT and excises revenue to contribution to solve the decreased revenue from trade tax, really if trade tax revenue losses reached 5.6 percentage points of trade tax to GDP and they didn't before this threshold. This reaction of their tax authorities can also explain the insignificant effect of their adopted VAT in their tax transition process.

[11] LAC Latin America and Caribbean

Table 1.5: Sub Saharan African countries : Probability model (equation 1)

	(1)	(2)	(3)	(4)
	Linear probability	Logit	Probit	IV probit
VARIABLES	tax transition	tax transition	tax transition	tax transition
Vat adoption	0.130***	0.163***	0.156***	0.135***
	(0.0287)	(0.0575)	(0.0538)	(0.0453)
Log(gdp capita)	0.0445*	0.0403	0.0430	0.0518*
	(0.0243)	(0.0365)	(0.0345)	(0.0289)
Log(trade)	-0.0901**	-0.0792	-0.0760	-0.111**
	(0.0377)	(0.0772)	(0.0726)	(0.0467)
Log(agriculture)	0.0430	0.0417	0.0420	0.0445
	(0.0277)	(0.0432)	(0.0415)	(0.0319)
Log(resource rents)	-0.0520***	-0.0601***	-0.0581***	-0.0565***
	(0.0104)	(0.0175)	(0.0168)	(0.0122)
Corruption	-0.00413	-0.0125	-0.0130	-0.00817
	(0.0154)	(0.0276)	(0.0265)	(0.0181)
Bureaucracy	-0.0261	-0.0113	-0.0108	-0.0288
	(0.0167)	(0.0266)	(0.0256)	(0.0194)
o.neighbors				-
o.distance				-
Constant	0.300			
	(0.271)			
Observations	1,073	1,073	1,073	1,073
R-squared	0.048			
Number of country_code	37	37	37	37
Wald test of exogeneity				0.6306

Robust standard errors in parentheses

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

Table 1.6: Compensatory and complementarity effect between VAT and excises : African countries

	(1)	(2)	(3)	(4)	(5)	(6)
	Fixed effect	Random effect	GMM	Fixed effect	Random effect	GMM
VARIABLES	vat	vat	vat	excises	excises	excises
L.vat			0.711***			
			(0.117)			
L.excises						0.612***
						(0.107)
Trade tax	-0.0398	-0.154	-0.375*	-0.0531*	-0.0657**	0.0807
	(0.188)	(0.199)	(0.217)	(0.0304)	(0.0297)	(0.0995)
Gdp capita	0.000983***	0.000693***	-1.93e-05	-8.72e-06	-2.37e-05	-4.40e-05
	(0.000234)	(0.000258)	(3.95e-05)	(3.71e-05)	(3.27e-05)	(3.80e-05)
Agriculture	-0.0490***	-0.0501***	-0.0160**	-0.00688**	-0.00707**	-0.0111*
	(0.0148)	(0.0148)	(0.00801)	(0.00321)	(0.00307)	(0.00633)
Trade	0.000823	0.000782	0.00643***	0.000314	0.000334	0.000261
	(0.00333)	(0.00334)	(0.00205)	(0.000858)	(0.000852)	(0.00140)
Resource rents	0.0170	0.0101	-0.0149**	-0.000519	-0.000935	-0.00209
	(0.0120)	(0.0137)	(0.00626)	(0.00267)	(0.00262)	(0.00435)
Corruption	-0.0952	-0.117	-0.0466	-0.0581**	-0.0570**	-0.00801
	(0.136)	(0.137)	(0.0574)	(0.0246)	(0.0243)	(0.0409)
Bureaucracy	-0.161	-0.171	0.0480	0.0125	0.0108	0.00762
	(0.190)	(0.189)	(0.0624)	(0.0281)	(0.0279)	(0.0329)
Trade tax^2	-0.00837	0.00119	0.0289*	0.00146	0.00202	-0.00993
	(0.0149)	(0.0166)	(0.0166)	(0.00267)	(0.00261)	(0.00852)
Constant	4.309***	5.149***	2.184***	1.780***	1.845***	0.780***
	(0.881)	(0.961)	(0.695)	(0.166)	(0.209)	(0.293)
Observations	1,073	1,073	1,036	1,073	1,073	1,036
R-squared	0.202			0.027		
Number of country_code	37	37	37	37	37	37
Ar(2) p-values			0.797			0.129
Hansen p-values			0.347			0.408
Ar(1) p-values			0.000			0.0105

Robust standard errors in parentheses

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

Table 1.7: South East and Pacific Asia : Probability model (equation 1).

VARIABLES	(1) Linear probability tax transition	(2) Logit tax transition	(3) Probit tax transition	(4) IV probit tax transition
Vat adoption	-0.0109	-0.0180	-0.0233	0.338***
	(0.0534)	(0.0913)	(0.0888)	(0.115)
Log(gdp capita)	-0.00190	0.0142	0.0152	-0.0458
	(0.0259)	(0.0404)	(0.0407)	(0.0308)
Log(trade)	0.0429	0.0779	0.0803	-0.00266
	(0.0333)	(0.0493)	(0.0500)	(0.0402)
Log(agriculture)	0.0746**	0.110**	0.113**	0.0301
	(0.0326)	(0.0479)	(0.0490)	(0.0449)
Log(resource rents)	-0.0224**	-0.0279*	-0.0284*	-0.0158
	(0.0109)	(0.0164)	(0.0164)	(0.0130)
Corruption	0.0150	0.0184	0.0180	0.0546**
	(0.0214)	(0.0285)	(0.0285)	(0.0248)
Bureaucracy	0.00142	0.00538	0.00714	-0.0390
	(0.0251)	(0.0349)	(0.0357)	(0.0285)
o.neighbors				-
o.distance				-
Constant	-0.0535			
	(0.324)			
Observations	609	609	609	609
R-squared	0.017			
Number of country_code	21	21	21	21
Wald test of exogeneity				0.100

Robust standard errors in parentheses

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

Table 1.8: Compensatory and complementarity effect between VAT and excises : Asian countries

	(1)	(2)	(3)	(4)	(5)	(6)
	Fixed effect	Random effect	GMM	Fixed effect	Random effect	GMM
VARIABLES	vat	vat	vat	excises	excises	excises
L.vat			1.050***			
			(0.105)			
L.excises						0.702***
						(0.0856)
Trade tax	-0.436	-0.452	-0.405*	0.0264	-0.00546	0.179
	(0.465)	(0.469)	(0.211)	(0.232)	(0.215)	(1.391)
Gdp capita	-5.52e-05**	-3.41e-05	-1.30e-05	-5.05e-05**	-2.67e-05**	-5.92e-06
	(2.52e-05)	(2.26e-05)	(2.37e-05)	(2.22e-05)	(1.21e-05)	(2.46e-05)
Agriculture	0.0142	0.00436	0.0103	-0.00642	-0.0160	-0.0100
	(0.0307)	(0.0311)	(0.00976)	(0.0188)	(0.0172)	(0.0127)
Trade	0.0212**	0.0180*	0.000362	0.00333	0.00155	-0.000430
	(0.0100)	(0.00993)	(0.00113)	(0.00257)	(0.00198)	(0.00130)
Resource rents	0.0389	0.0303	-0.00691	0.0193	0.00869	-0.00353
	(0.0289)	(0.0280)	(0.00762)	(0.0160)	(0.0169)	(0.00964)
Corruption	-0.310**	-0.252*	0.0180	-0.0869	-0.0137	0.00706
	(0.148)	(0.151)	(0.0883)	(0.0771)	(0.0698)	(0.0763)
Bureaucracy	0.355	0.338	0.0237	-0.305	-0.318	0.0438
	(0.315)	(0.320)	(0.0835)	(0.241)	(0.244)	(0.0977)
Trade tax^2	0.0553	0.0559	0.0655	0.0169	0.0219	-0.0323
	(0.0610)	(0.0616)	(0.243)	(0.0292)	(0.0270)	(0.235)
Constant	3.542**	3.703***	0.0891	2.806***	2.780***	0.559
	(1.246)	(1.433)	(1.638)	(0.842)	(0.853)	(1.072)
Observations	609	609	588	609	609	588
R-squared	0.227			0.108		
Number of country_code	21	21	21	21	21	21
Ar(2) p-values			0.916			0.523
Hansen p-values			0.181			0.301
Ar(1) p-values			0.002			0.044

Robust standard errors in parentheses

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

Table 1.9: Latin American and Caribbean : Probability model (equation 1).

VARIABLES	(1) Linear probability tax transition	(2) Logit tax transition	(3) Probit tax transition	(4) IV probit tax transition
Vat adoption	0.0410	0.0285	0.0250	0.0289
	(0.0700)	(0.120)	(0.113)	(0.141)
Log(gdp capita)	0.0700	0.0995	0.104	0.0760
	(0.0472)	(0.0876)	(0.0883)	(0.0545)
Log(trade)	-0.0963**	-0.0924	-0.0898	-0.103**
	(0.0401)	(0.0639)	(0.0634)	(0.0483)
Log(agriculture)	0.0601	0.0628	0.0639	0.0635
	(0.0406)	(0.0533)	(0.0531)	(0.0499)
Log(resource rents)	-0.00297	-0.00432	-0.00492	-0.00594
	(0.0155)	(0.0224)	(0.0223)	(0.0191)
Corruption	0.0186	0.0193	0.0185	0.0229
	(0.0254)	(0.0295)	(0.0293)	(0.0266)
Bureaucracy	0.0856***	0.0948**	0.0926**	0.0977***
	(0.0273)	(0.0430)	(0.0413)	(0.0317)
o.neighbors				-
o.distance				-
Constant	-0.180			
	(0.511)			
Observations	609	609	609	609
R-squared	0.064			
Number of country_code	21	21	21	21
Wald test of exogeneity				0.8626

Robust standard errors in parentheses

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

Table 1.10: Compensatory and complementarity effect between VAT and excises : LAC countries

	(1)	(2)	(3)	(4)	(5)	(6)
	Fixed effect	Random effect	GMM	Fixed effect	Random effect	GMM
VARIABLES	vat	vat	vat	excises	excises	excises
L.vat			0.776***			
			(0.0928)			
L.excises						0.654***
						(0.125)
Trade tax	-0.580*	-0.570**	1.421**	0.132	0.137	0.569*
	(0.302)	(0.282)	(0.603)	(0.109)	(0.102)	(0.290)
Gdp capita	0.000102	9.87e-05	8.89e-05	-4.90e-05	-4.39e-05	2.48e-05
	(0.000150)	(0.000141)	(5.43e-05)	(3.46e-05)	(3.02e-05)	(2.77e-05)
Agriculture	-0.135**	-0.124**	-0.00409	-0.00234	-0.00901	-0.0116
	(0.0604)	(0.0599)	(0.0198)	(0.0150)	(0.0135)	(0.0108)
Trade	0.0194**	0.0187**	-0.00682	-0.00348	-0.00328*	-0.00235
	(0.00860)	(0.00787)	(0.00480)	(0.00212)	(0.00181)	(0.00281)
Resource rents	-0.0603	-0.0534	-0.000811	0.00204	-0.00137	-0.0201
	(0.0390)	(0.0381)	(0.0224)	(0.0141)	(0.0138)	(0.0138)
Corruption	-0.373**	-0.388***	-0.163	0.0656	0.0785*	0.0153
	(0.141)	(0.138)	(0.133)	(0.0442)	(0.0431)	(0.0292)
Bureaucracy	0.166	0.200	0.385***	-0.0654	-0.0759	0.0266
	(0.271)	(0.264)	(0.146)	(0.0844)	(0.0821)	(0.0550)
Trade tax^2	0.0340*	0.0352**	-0.127**	-0.00858	-0.00877	-0.0503*
	(0.0184)	(0.0173)	(0.0541)	(0.00761)	(0.00732)	(0.0276)
Constant	6.883***	6.723***	-0.831	1.935***	1.971***	-0.0463
	(1.518)	(1.410)	(0.661)	(0.359)	(0.428)	(0.418)
Observations	609	609	588	609	609	588
R-squared	0.219			0.083		
Number of country_code	21	21	21	21	21	21
Ar(2) p-values			0.489			0.562
Hansen p-values			0.536			0.127
Ar(1) p-values			0.002			0.019

Robust standard errors in parentheses

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

1.7.2 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 a common external tariff that limits 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 across 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 limits the revenue contribution of trade taxes as compared to domestic revenue mobilization.

We aim in this section to assess the likelihood of succeeding tax transition by VAT in these countries as well quantify the compensation ratio with VAT and excises. Results are given in table 1.11 and 1.12.

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 1.11. The probability of meeting transition (30%) is higher than the one obtained on the total sample. We do not find any nonlinear relationship in table 1.12 concerning the compensation ratio. This is not surprising since the adoption of common external tariff limits 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 as compared to the total sample. But as compared to African countries they did. As said earlier, the fact that they have a greater probability of succeeding transition can be due to coordination measures that help enhance domestic revenue mobilization. Finally, we also find the one-sided ineffective nature of excises in the transition process of these countries. Perhaps excises, could be at work while summing it with VAT as domestic indirect taxes.

Table 1.11: Case WAEMU countries: Probability model

VARIABLES	(1) Linear probability tax transition	(2) Logit tax transition	(3) Probit tax transition	(4) IV probit tax transition
Vat adoption	0.189***	0.319**	0.300***	0.302*
	(0.0727)	(0.130)	(0.112)	(0.158)
Log(gdp capita)	-0.105	-0.262	-0.239	-0.144
	(0.112)	(0.180)	(0.156)	(0.125)
Log(trade)	0.0727	0.373	0.356	0.100
	(0.147)	(0.492)	(0.465)	(0.160)
Log(agriculture)	-0.358*	-0.214	-0.207	-0.366*
	(0.185)	(0.280)	(0.276)	(0.193)
Log(resource rents)	0.0627	-0.0192	-0.0108	0.0683
	(0.0740)	(0.0998)	(0.0965)	(0.0835)
Corruption	0.0226	0.0191	0.0191	0.0396
	(0.0433)	(0.0756)	(0.0722)	(0.0505)
Bureaucracy	0.0169	0.0424	0.0401	0.0197
	(0.0469)	(0.0434)	(0.0399)	(0.0479)
o.neighbors				-
o.distance				-
Constant	1.624			
	(1.186)			
Observations	232	232	232	232
R-squared	0.070			
Number of country_code	8	8	8	8
Wald test of exogeneity				0.6349

Robust standard errors in parentheses

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

Table 1.12: Compensatory and complementarity effect: WAEMU countries

	(1)	(2)	(3)	(4)	(5)	(6)
	FE	RE	GMM	FE	RE	GMM
VARIABLES	vat	vat	vat	excises	excises	excises
L.vat			0.811***			
			(0.231)			
L.excises						1.063***
						(0.196)
Trade tax	-0.132	-0.329	-0.594*	-0.130	-0.0854	-0.0393
	(0.416)	(0.0598)	(0.317)	(0.0811)	(0.162)	(0.650)
Gdp capita	0.01000**	0.00398***	0.00333**	0.00131	5.26e-05	-0.000620
	(0.00294)	(0.000579)	(0.00154)	(0.00102)	(0.000134)	(0.00135)
Agriculture	-0.122*	-0.145***	0.0244	-0.000933	-0.0369***	0.00408
	(0.0546)	(0.0195)	(0.0283)	(0.00669)	(0.00734)	(0.0225)
Trade	-0.00161	-0.0439***	0.00947	0.00446	0.00206	0.00865
	(0.0174)	(0.0132)	(0.0161)	(0.00316)	(0.00424)	(0.00638)
Resource rents	0.0587	0.0650	-0.0524	0.00560	0.0152	-0.0130
	(0.0388)	(0.0396)	(0.0383)	(0.00860)	(0.00926)	(0.0236)
Corruption	0.0122	-0.0747	-0.0203	-0.0767	-0.114*	-0.0314
	(0.264)	(0.240)	(0.142)	(0.0432)	(0.0620)	(0.0828)
Bureaucracy	-0.386	-0.344	-0.0735	0.0164	0.0997***	0.101
	(0.570)	(0.402)	(0.125)	(0.0801)	(0.0360)	(0.0713)
Trade tax^2	-0.00985	0.0113	0.0569	0.00423	-0.00030	-0.000638
	(0.0416)	(0.0585)	(0.0836)	(0.00772)	(0.0150)	(0.0671)
Constant	1.468	9.276***	-2.519	0.159	2.197**	-2.539
	(1.881)	(1.471)	(6.969)	(0.791)	(0.996)	(6.996)
Observations	232	232	216	232	232	216
R-squared	0.402			0.232		
Number of country_code	8	8	8	8	8	8
Ar(2) p-values			0.512			0.850
Hansen p-values			0.900			0.990
Ar(1) p-values			0.0308			0.0235

Robust standard errors in parentheses

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

1.7.3 Do the number of years a country has 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 experience 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 1.13 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.

Table 1.13: Robustness check adding the number of years a country have VAT.

	(1)	(2)	(3)	(4)
	Linear probability	Logit	Probit	IV probit
VARIABLES	tax transition	tax transition	tax transition	tax transition
Vat adoption	0.0810***	0.0951**	0.0919**	0.114*
	(0.0259)	(0.0451)	(0.0437)	(0.0613)
Number year vat	0.000951	0.000299	0.000239	0.000184
	(0.00137)	(0.00225)	(0.00223)	(0.00210)
Log(gdp capita)	0.0224*	0.0306	0.0314	0.0223*
	(0.0125)	(0.0235)	(0.0231)	(0.0134)
Log(trade)	-0.0147	0.0112	0.0120	-0.0152
	(0.0189)	(0.0369)	(0.0362)	(0.0195)
Log(agriculture)	0.0547***	0.0721**	0.0716**	0.0573***
	(0.0151)	(0.0290)	(0.0287)	(0.0166)
Log(resource rents)	-0.0251***	-0.0323***	-0.0317***	-0.0262***
	(0.00509)	(0.0102)	(0.0102)	(0.00531)
Corruption	0.00724	-0.000234	-0.000872	0.00745
	(0.00996)	(0.0166)	(0.0163)	(0.0105)
Bureaucracy	0.0112	0.0206	0.0212	0.0123
	(0.0110)	(0.0185)	(0.0182)	(0.0117)
o.neighbors				-
o.distance				-
Constant	-0.00134			
	(0.150)			
Observations	2,755	2,755	2,755	2,755
R-squared	0.022			
Number of country code	96	96	96	96
Wald test of exogeneity				0.5939

Robust standard errors in parentheses

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

1.7.4 Changing the dependent variable

1.7.4.1 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 1.14.

We observe in column 4 that, the probability of succeeding tax transition with VAT decreased by 5%. This result suggests that, tax effort strongly matters, if one wants to address transition performance in developing countries.

Table 1.14: Hardening transition condition 1.

	(1)	(2)	(3)	(4)
	Linear probability	Logit	Probit	IV probit
VARIABLES	tax transition(2)	tax transition(2)	tax transition(2)	tax transition(2)
Vat adoption	-0.0411***	-0.0106	-0.0131*	-0.0551***
	(0.0140)	(0.00657)	(0.00794)	(0.0160)
Log(gdp capita)	0.0746***	0.0198**	0.0243**	0.0646***
	(0.00933)	(0.00864)	(0.0109)	(0.00698)
Log(trade)	0.0316**	0.00839	0.0101	0.0290***
	(0.0127)	(0.0104)	(0.0122)	(0.00945)
Log(agriculture)	0.0419***	0.000861	0.00229	0.0274***
	(0.0128)	(0.00832)	(0.00987)	(0.00848)
Log(resource rents)	-0.0226***	-0.00435	-0.00511	-0.0115***
	(0.00407)	(0.00299)	(0.00365)	(0.00244)
Corruption	0.00507	-0.000377	-0.000635	-0.00265
	(0.00663)	(0.00327)	(0.00394)	(0.00547)
Bureaucracy	0.00737	0.00554	0.00663	0.00378
	(0.00721)	(0.00420)	(0.00516)	(0.00592)
o.neighbors				-
o.distance				-
Constant	-0.664***			
	(0.111)			
Observations	2,755	2,755	2,755	2,755
R-squared	0.094			
Number of country code	96	96	96	96
Wald test of exogeneity				0.666

Robust standard errors in parentheses

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

1.7.4.2 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 1.15.
It indicates that domestic revenue is unlike to cover that of international trade in the short-term, since our results pointed out that, the likelihood of succeeding tax transition decreased by 4%. Confronting this estimate to our baseline estimate, we rather posit the fact that, the tax transition effect of VAT truly occurs in the mid-term.

Table 1.15: Allowing for 3 years interval bounds (assumption 2 and 3 of condition 2).

	(1)	(2)	(3)	(4)
	Linear probability	Logit	Probit	IV probit
VARIABLES	tax transition(3)	tax transition(3)	tax transition(3)	tax transition(3)
Vat adoption	-0.0436***	-0.0122*	-0.0147*	-0.0445**
	(0.0144)	(0.00710)	(0.00873)	(0.0175)
Log(gdp capita)	0.0641***	0.0225***	0.0284***	0.0571***
	(0.00969)	(0.00831)	(0.0107)	(0.00743)
Log(trade)	0.0467***	0.0287**	0.0353**	0.0428***
	(0.0134)	(0.0130)	(0.0161)	(0.0108)
Log(agriculture)	0.0370***	0.000922	0.00225	0.0252***
	(0.0134)	(0.0100)	(0.0127)	(0.00937)
Log(resource rents)	-0.0180***	-0.00367	-0.00427	-0.00988***
	(0.00407)	(0.00319)	(0.00400)	(0.00264)
Corruption	0.0130*	0.00491	0.00690	0.00616
	(0.00678)	(0.00382)	(0.00488)	(0.00587)
Bureaucracy	0.00911	0.00779	0.00931	0.00502
	(0.00737)	(0.00511)	(0.00650)	(0.00651)
o.neighbors				-
o.distance				-
Constant	-0.656***			
	(0.120)			
Observations	2,755	2,755	2,755	2,755
R-squared	0.078			
Number of country code	96	96	96	96
Wald test of exogeneity				0.4792

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

1.7.4.3 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 meets 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 increases 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. Results are given in table 1.16.

Our results are 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 1.16.

Table 1.16: Duration model of tax transition

	(1)	(2)
	Tobit	IV Tobit
VARIABLES	tax transition(4)	tax transition(4)
Vat adoption	1.390***	2.157***
	(0.233)	(0.348)
Log(gdp capita)	0.364*	0.157
	(0.206)	(0.115)
Log(trade)	0.560**	-0.120
	(0.272)	(0.168)
Log(agriculture)	0.349	0.417***
	(0.243)	(0.144)
Log(resource rents)	-0.200***	-0.238***
	(0.0765)	(0.0471)
Corruption	-0.188*	-0.0323
	(0.104)	(0.0899)
Bureaucracy	0.271**	0.200**
	(0.122)	(0.101)
o.neighbors		-
o.distance		-
Observations	2,755	2,755
Number of country code	96	96
Wald test of exogeneity		0.159

Robust standard errors in parentheses

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

1.7.5 The question of delays between the adopted VAT and a successful tax transition reform

.

We deepen the tax transition effect of VAT, now considering the fact that, if countries meet their transition process with VAT, it would be wise to know if they must quickly anticipate the adoption of VAT, or VAT is powerful enough to raise revenue at any point of time. Answering this question is particularly important as it serves to guide policymakers in the adoption of VAT. We found in table 1.17 that, it is more likely to succeed tax transition with VAT if it is quickly adopted one year before. Results in column 4 pointed out that developing countries have six times more chance to succeed tax transition with VAT, if VAT is adopted one year before the tax transition reform. Curiously, its effects shrink over time, and our results indicate that having VAT two or three years before didn't necessarily show cumulative effect in the tax transition process of developing countries. This is consistent with results obtained in section 7.3, that highlight the fact that managing VAT over time is rather an art, than its cumulative effects.

Table 1.17: Delays between the adopted VAT and a successful tax transition

	(1)	(2)	(3)	(4)
	Linear probability	Logit	Probit	IV probit
VARIABLES	tax transition	tax transition	tax transition	tax transition
Vat adoption(t-1)	0.187***	0.206***	0.202***	0.797***
	(0.0633)	(0.0636)	(0.0635)	(0.288)
Vat adoption(t-2)	0.000813	-0.00371	-0.00355	-0.539
	(0.0845)	(0.0816)	(0.0825)	(0.367)
Vat adoption(t-3)	-0.0957	-0.0979	-0.0951	-0.0899
	(0.0827)	(0.0834)	(0.0830)	(0.0790)
Vat adoption(t-4)	0.0759	0.0841	0.0828	0.0739
	(0.0833)	(0.0834)	(0.0824)	(0.0795)
Vat adoption(t-5)	-0.0595	-0.0840	-0.0853	-0.0542
	(0.0617)	(0.0597)	(0.0594)	(0.0570)
Log(gdp capita)	0.00540	0.00789	0.00818	0.000114
	(0.0137)	(0.0234)	(0.0232)	(0.0145)
Log(trade)	-0.0159	0.0192	0.0207	-0.0157
	(0.0214)	(0.0342)	(0.0339)	(0.0218)
Log(agriculture)	0.0489***	0.0696**	0.0690**	0.0491***
	(0.0160)	(0.0288)	(0.0283)	(0.0175)
Log(resource rents)	-0.0287***	-0.0360***	-0.0357***	-0.0289***
	(0.00552)	(0.00912)	(0.00906)	(0.00579)
Corruption	0.0142	0.00399	0.00297	0.0196*
	(0.0113)	(0.0147)	(0.0145)	(0.0119)
Bureaucracy	0.0141	0.0324*	0.0319*	0.0144
	(0.0125)	(0.0175)	(0.0172)	(0.0131)
o.neighbors				-
o.distance				-
Constant	0.114			
	(0.166)			
Observations	2,280	2,280	2,280	2,280
R-squared	0.028			
Number of country code	96	96	96	96
Wald test of exogeneity				0.372

Robust standard errors in parentheses

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

1.7.6 The role of foreign aid and remittances

Another question concerns the role of external funding in succeeding internal tax reform. A body of the aid-tax mobilization literature asked the question about if aid is a complement to tax revenue or if it crowds-out tax effort of countries. Clearly, the answer of this question is found to be mixed . For example Kaldor (1962) found that aid as an additional source of government finance leads government to less tax effort. Conversely, costs associated with aid instability oblige them to increase their tax effort in response to aid volatility. Other authors pointed out the fact that technical assistance that goes with aid is an important factor that helps increase tax revenue (Brun, Chambas, & Guerineau, 2011). Or, the fact that aid is conditioned on countries tax revenue performance made it complementary with domestic tax revenue.

For remittances, C. H. Ebeke (2011) documents a VAT tax revenue effect of remittances in developing countries due to the fact that remittances are largely used for consumption purposes and help smooth consumption shocks over time that lead to high VAT tax revenue. But one can also think that the effect is not linear, and that the beneficial effect of remittances can occur if the additional consumption effect of remittances is not targeted on VAT exempted goods. In the case where poor households spend remittances on exempted goods, remittances could have no chance to affect VAT tax revenue. We present in table 1.18 and table 1.19 the results of the VAT tax transition effects in countries that receive high(low) aid/remittances[12].

Results indicate that VAT transition effect is more likely to occur in countries that receive less aid. This is curious, but one can think that countries that receive less aid are the ones that made substantial tax effort independently of aid, and in response to its volatility. Aid perhaps may crowd-out tax revenue effort in countries that receive high aid. For remittances, we find very nearly results in high remittances countries and in low ones, with nearly standard errors. So, the VAT adoption tax transition effect is practically the same in high/low remittances receiving countries. If remittances are spent on exempted goods, it can explain part of the unexpected effect we found in high remittances countries.

[12]This was done by splitting our sample according to the median of aid and remittances. Another issue is to interact VAT adoption dummy with aid or remittances. But our estimation are not convergent due to the problem of interaction terms in nonlinear probit/logit model highlighted by (Ai & Norton, 2003)

Table 1.18: Role of aid

High Aid					Low Aid				
	(1)	(2)	(3)	(4)		(1)	(2)	(3)	(4)
	Linear probability	Logit	Probit	IV probit		Linear probability	Logit	Probit	IV probit
VARIABLES	tax transition	tax transition	tax transition	tax transition	VARIABLES	tax transition	tax transition	tax transition	tax transition
Vat adoption	0.0546**	0.0829*	0.0809*	0.0567	Vat adoption	0.127***	0.144*	0.136*	0.197**
	(0.0244)	(0.0449)	(0.0437)	(0.0387)		(0.0411)	(0.0755)	(0.0712)	(0.0770)
Log(gdp capita)	0.00788	0.00890	0.0106	0.00813	Log(gdp capita)	0.0133	0.0220	0.0223	0.00817
	(0.0150)	(0.0281)	(0.0276)	(0.0159)		(0.0256)	(0.0381)	(0.0377)	(0.0275)
Log(trade)	0.0140	0.0369	0.0369	0.0126	Log(trade)	-0.0509*	-0.0381	-0.0371	-0.0469
	(0.0243)	(0.0436)	(0.0431)	(0.0252)		(0.0292)	(0.0383)	(0.0376)	(0.0298)
Log(agriculture)	0.0495***	0.0691*	0.0703*	0.0508**	Log(agriculture)	0.0576**	0.0490	0.0491	0.0617**
	(0.0188)	(0.0386)	(0.0380)	(0.0202)		(0.0272)	(0.0462)	(0.0452)	(0.0301)
Log(resource rents)	-0.0239***	-0.0337***	-0.0333***	-0.0245***	Log(resource rents)	-0.0305***	-0.0322**	-0.0316**	-0.0325***
	(0.00784)	(0.0125)	(0.0124)	(0.00810)		(0.00769)	(0.0151)	(0.0148)	(0.00801)
Corruption	-0.00324	-0.0158	-0.0162	-0.00357	Corruption	0.0326**	0.0257	0.0253	0.0375**
	(0.0125)	(0.0193)	(0.0191)	(0.0133)		(0.0166)	(0.0267)	(0.0262)	(0.0174)
Bureaucracy	0.00880	0.0212	0.0222	0.00919	Bureaucracy	0.0384**	0.0353	0.0343	0.0415**
	(0.0137)	(0.0192)	(0.0191)	(0.0142)		(0.0190)	(0.0326)	(0.0318)	(0.0202)
o.neighbors				-	o.neighbors				-
o.distance				-	o.distance				-
Constant	0.0222				Constant	0.115			
	(0.180)					(0.285)			
Observations	1,527	1,527	1,527	1,527	Observations	1,228	1,228	1,228	1,228
R-squared	0.012				R-squared	0.038			
Number of country code	54	54	54	54	Number of country code	43	43	43	43
Level of aid(Median)	High	High	High	High	Level of aid(Median)	Low	Low	Low	Low
Wald test of exogeneity				0.9902	Wald test of exogeneity				0.2800
Robust standard errors in parentheses					Robust standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1					*** p<0.01, ** p<0.05, * p<0.1				

Table 1.19: Role of remittances

High remittances					Low remittances				
	(1)	(2)	(3)	(4)		(1)	(2)	(3)	(4)
	Linear probability	Logit	Probit	IV probit		Linear probability	Logit	Probit	IV probit
VARIABLES	tax transition	tax transition	tax transition	tax transition	VARIABLES	tax transition	tax transition	tax transition	tax transition
Vat_adoption	0.0812***	0.0781	0.0753	0.110**	Vat adoption	0.0935***	0.105*	0.105**	0.121**
	(0.0272)	(0.0516)	(0.0497)	(0.0462)		(0.0318)	(0.0549)	(0.0530)	(0.0584)
Log(gdp capita)	0.0300*	0.0294	0.0297	0.0286	Log(gdp capita)	0.0731***	0.0866**	0.0856**	0.0791***
	(0.0179)	(0.0342)	(0.0335)	(0.0197)		(0.0208)	(0.0397)	(0.0388)	(0.0236)
Log(trade)	-0.0591**	-0.0244	-0.0219	-0.0608**	Log(trade)	-0.00918	-0.00846	-0.00656	-0.0144
	(0.0263)	(0.0523)	(0.0505)	(0.0285)		(0.0285)	(0.0585)	(0.0590)	(0.0293)
Log(agriculture)	0.0317	0.0378	0.0381	0.0331	Log(agriculture)	0.115***	0.138***	0.136***	0.129***
	(0.0209)	(0.0461)	(0.0453)	(0.0225)		(0.0263)	(0.0519)	(0.0506)	(0.0327)
Log(resource rents)	-0.0196**	-0.0312**	-0.0307**	-0.0221***	Log(resource rents)	-0.0164**	-0.0254	-0.0248	-0.0167**
	(0.00801)	(0.0144)	(0.0142)	(0.00851)		(0.00743)	(0.0165)	(0.0169)	(0.00746)
Corruption	-0.0120	-0.0348	-0.0352	-0.0112	Corruption	0.0304**	0.0313*	0.0313*	0.0314**
	(0.0139)	(0.0265)	(0.0257)	(0.0155)		(0.0139)	(0.0188)	(0.0187)	(0.0147)
Bureaucracy	0.0406**	0.0445*	0.0445*	0.0417**	Bureaucracy	-0.0258	-0.0173	-0.0163	-0.0256
	(0.0160)	(0.0264)	(0.0254)	(0.0176)		(0.0159)	(0.0220)	(0.0219)	(0.0167)
o.neighbors				-	o.neighbors				-
o.distance				-	o.distance				-
Constant	0.228				Constant	-0.616***			
	(0.200)					(0.237)			
Observations	1,561	1,561	1,561	1,561	Observations	1,194	1,194	1,194	1,194
R-squared	0.025				R-squared	0.035			
Number of country code	55	55	55	55	Number of country code	42	42	42	42
Level of remittances(Median)	High	High	High	High	Level of remittances(Median)	Low	Low	Low	Low
Wald test of exogeneity				0.5223	Wald test of exogeneity				0.6504
Robust standard errors in parentheses					Robust standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1					*** p<0.01, ** p<0.05, * p<0.1				

1.7.7 Tax potential estimated by the SFM models

.

We estimate the Kumbhakar et al. (2014) technical efficiency model to predict tax effort of countries as a robustness check to the one obtained with the least-squares method. The model allows us to disentangle between time invarying technical efficiency (persistent tax effort) and time- varying technical efficiency(residual tax effort). The persistent tax effort is due to the stability of tax law, while the residual efficiency, to tax administration. This distinction is reliable since it helps provide more insights about the successfulness of the transition reform with VAT. Results are given in table 1.20 and table 1.21.

Our results pointed out that, the successfulness of the tax transition reform with VAT, is more guided by the effectiveness of tax administration as compared to policy. Both are necessary, but we found high probability with administration. Thus, for a given level of policy, tax authorities must enhance tax administration if they want to take full advantage from the adoption of VAT.

Table 1.20: Robustness check with stochastic frontier method: Persistent tax effort

	(1)	(2)	(3)	(4)
	Linear probability	Logit	Probit	IV probit
VARIABLES	tax transition(5)	tax transition(5)	tax transition(5)	tax transition(5)
Vat adoption	0.104***	0.107***	0.102***	0.119***
	(0.0208)	(0.0411)	(0.0395)	(0.0359)
Log(gdp capita)	0.0189	0.0189	0.0203	0.0187
	(0.0120)	(0.0327)	(0.0323)	(0.0134)
Log(trade)	0.0111	0.0736	0.0748	0.0121
	(0.0189)	(0.0474)	(0.0465)	(0.0196)
Log(agriculture)	0.0811***	0.102**	0.102**	0.0874***
	(0.0146)	(0.0481)	(0.0474)	(0.0169)
Log(resource rents)	-0.0276***	-0.0402***	-0.0395***	-0.0294***
	(0.00502)	(0.0147)	(0.0146)	(0.00538)
Corruption	0.0121	-0.00306	-0.00335	0.0135
	(0.0100)	(0.0169)	(0.0166)	(0.0108)
Bureaucracy	0.0139	0.0301	0.0308*	0.0152
	(0.0110)	(0.0189)	(0.0186)	(0.0117)
o.neighbors				-
o.distance				-
Constant	-0.161			
	(0.150)			
Observations	2,755	2,755	2,755	2,755
R-squared	0.026			
Number of country code	96	96	96	96
Wald test of exogeneity				0.7101

Robust standard errors in parentheses

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

Table 1.21: Robustness check with stochastic frontier method: Time-varying tax effort

	(1)	(2)	(3)	(4)
	Linear probabilty	Logit	Probit	IV probit
VARIABLES	tax transition(6)	tax transition(6)	tax transition(6)	tax transition(6)
Vat adoption	0.113***	0.131***	0.125***	0.191***
	(0.0205)	(0.0421)	(0.0401)	(0.0365)
Log(gdp capita)	0.00608	0.00132	0.00246	-0.00160
	(0.0125)	(0.0265)	(0.0260)	(0.0139)
Log(trade)	0.0470**	0.0876**	0.0871**	0.0524***
	(0.0187)	(0.0358)	(0.0348)	(0.0198)
Log(agriculture)	0.0406***	0.0454	0.0449	0.0422**
	(0.0156)	(0.0356)	(0.0351)	(0.0170)
Log(resource rents)	-0.0193***	-0.0260**	-0.0253**	-0.0209***
	(0.00509)	(0.0106)	(0.0104)	(0.00539)
Corruption	0.00688	-0.00428	-0.00463	0.0123
	(0.00982)	(0.0165)	(0.0163)	(0.0108)
Bureaucracy	0.0189*	0.0392*	0.0398*	0.0195
	(0.0110)	(0.0212)	(0.0208)	(0.0119)
o.neighbors				-
o.distance				-
Constant	-0.126			
	(0.151)			
Observations	2,755	2,755	2,755	2,755
R-squared	0.022			
Number of country code	96	96	96	96
Wald test of exogeneity				0.101

Robust standard errors in parentheses

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

1.7.8 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 1.22 suggest that, neither VAT nor excises are increasing significantly the period over which 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 consistent with increase in trade tax revenue. We suspect a compliance gap in mobilizing VAT revenue over this period. Thus, VAT and excises policies merit close attention, to address empirically the robustness of

VAT and excises as powerful effective first wave tax transition tools in developing countries.

Table 1.22: Investigating for asymmetries

Negative				Positive		
	(1)	(2)	(3)	(4)	(5)	(6)
	Fixed effect	Random effect	GMM	Fixed effect	Random effect	GMM
VARIABLES	Δvat	Δvat	Δvat	Δvat	Δvat	Δvat
L.Δvat			-0.00365			
			(0.0577)			
Δtrade tax(-)	-0.0300	-0.0401	-0.0747*			
	(0.0378)	(0.0337)	(0.0405)			
Δgdp_capita	0.000181**	0.000109*	0.000141*	2.73e-06	-2.03e-05	2.42e-05
	(7.66e-05)	(6.00e-05)	(7.55e-05)	(9.21e-05)	(7.77e-05)	(5.97e-05)
Δtrade	0.00444***	0.00434***	0.00608**	0.000190	0.00115	-1.78e-07
	(0.00168)	(0.00164)	(0.00274)	(0.00194)	(0.00190)	(0.00303)
Δagriculture	-0.00956	-0.00929	-0.0177	-0.00853	-0.0126	-0.0154
	(0.00861)	(0.00843)	(0.0124)	(0.00936)	(0.00919)	(0.0101)
Δresource rents	-0.0133**	-0.0144**	-0.0157***	-0.00580	-0.00924	-0.00700
	(0.00618)	(0.00606)	(0.00536)	(0.00748)	(0.00734)	(0.00542)
Δcorruption	-0.138**	-0.115*	-0.0709	-0.00396	0.00351	-0.0593
	(0.0645)	(0.0631)	(0.0507)	(0.0729)	(0.0714)	(0.0703)
Δbureaucracy	0.177	0.152	-0.0179	0.231*	0.222*	0.0900
	(0.116)	(0.110)	(0.158)	(0.131)	(0.127)	(0.119)
L.Δvat						0.00670
						(0.0512)
Δtrade tax(+)				0.0899**	0.0576	0.00551
				(0.0414)	(0.0370)	(0.190)
Constant	-0.0247	-0.0207	-0.0346	0.123***	0.137***	0.139**
	(0.0274)	(0.0263)	(0.154)	(0.0306)	(0.0312)	(0.0699)
Observations	1,505	1,505	1,456	1,279	1,279	1,230
R-squared	0.017			0.008		
Number of country_code	96	96	96	96	96	96
Ar(2) p-values			0.423			0.484
Hansen p-values			0.334			0.629
Ar(1) p-values			0.0020			0.0158

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	GMM	Fixed effect	Random effect	GMM
VARIABLES	Δexcises	Δexcises	Δexcises	Δexcises	Δexcises	Δexcises
L. Δexcises			0.210			
			(0.229)			
Δtrade tax(-)	0.0353	0.0206	0.0643			
	(0.0346)	(0.0288)	(0.206)			
Δgdp_capita	-4.32e-05	-5.00e-05	-6.78e-06	3.18e-07	-8.51e-06	3.46e-05
	(5.84e-05)	(4.36e-05)	(3.44e-05)	(4.96e-05)	(3.40e-05)	(5.86e-05)
Δtrade	3.27e-05	0.000123	0.000502	-0.00275	-0.00233	-0.00363
	(0.000986)	(0.00101)	(0.00121)	(0.00202)	(0.00182)	(0.00293)
Δagriculture	0.000217	0.000494	-0.00364	0.00648	0.00337	0.0125
	(0.00555)	(0.00534)	(0.00540)	(0.00612)	(0.00537)	(0.00821)
Δresource rents	-0.00252	-0.000931	-0.00181	0.00282	0.00339	-0.000505
	(0.00409)	(0.00373)	(0.00272)	(0.00682)	(0.00621)	(0.00491)
Δcorruption	-0.0116	-0.0149	0.0105	0.0555	0.0617	-0.0227
	(0.0447)	(0.0472)	(0.0357)	(0.0424)	(0.0413)	(0.0903)
Δbureaucracy	-0.0320	-0.0138	0.0143	-0.389	-0.328	-0.207
	(0.0483)	(0.0446)	(0.0809)	(0.258)	(0.230)	(0.129)
L. Δexcises						0.0701
						(0.0431)
Δtrade tax(+)				-0.00592	-0.0179	0.0342
				(0.0433)	(0.0369)	(0.124)
Constant	0.00409	-0.00117	0.00349	0.0139	0.0179	-0.00608
	(0.0128)	(0.0206)	(0.0797)	(0.0186)	(0.0175)	(0.0551)
Observations	1,505	1,505	1,456	1,279	1,279	1,230
R-squared	0.002			0.010		
Number of country_code	96	96	96	96	96	96
Ar(2) p-values			0.148			0.185
Hansen p-values			0.565			0.476
Ar(1) p-values			0.0376			0.0786

Robust standard errors in parentheses

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

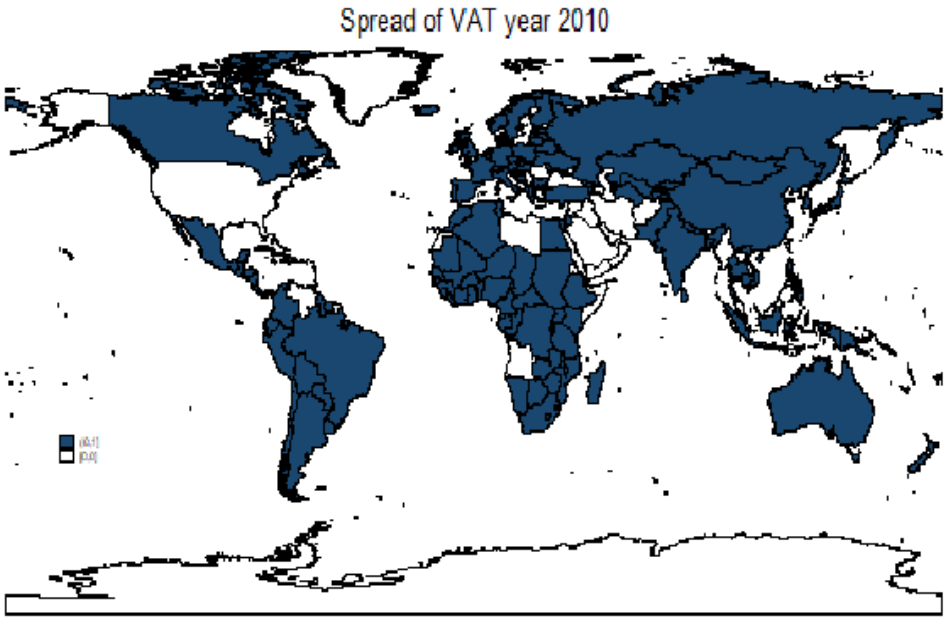
1.8 Conclusion

.

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 helps developing countries succeeding tax transition. We find that this effect is robust for African and Asian countries, but not for LAC countries. African countries even if they succeed tax transition with VAT, have the lowest compensation ratio of their trade tax revenue with VAT. For these countries the major concern of their VAT systems, is the multiplicity of derogatory regimes, that weaken the return of their VAT. In such context, they must carry out an assessment of their VAT gap, and find alternative instruments such as subsidies, to deal with poverty, if they want to offset more their trade tax revenues with VAT. Addressing the quality of 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 developing countries face an increase in their trade tax. We suspect a compliance gap in mobilizing VAT and excises over these periods. Further to this study, we suggest developing countries that have not yet adopted VAT, to quickly adopt it, in order to succeed with this reform, but also those with VAT, to take steps towards modernizing their VAT tax administration[13] in order to sufficiently gain from the revenue replacement strategy.

[13]For example the adoption of a unique tax identifier number by the tax administration would notably help secure more VAT revenue and foster the transition process in these countries.

Appendix 1 : Spread of VAT, year 2010



Source : Author with IMF data

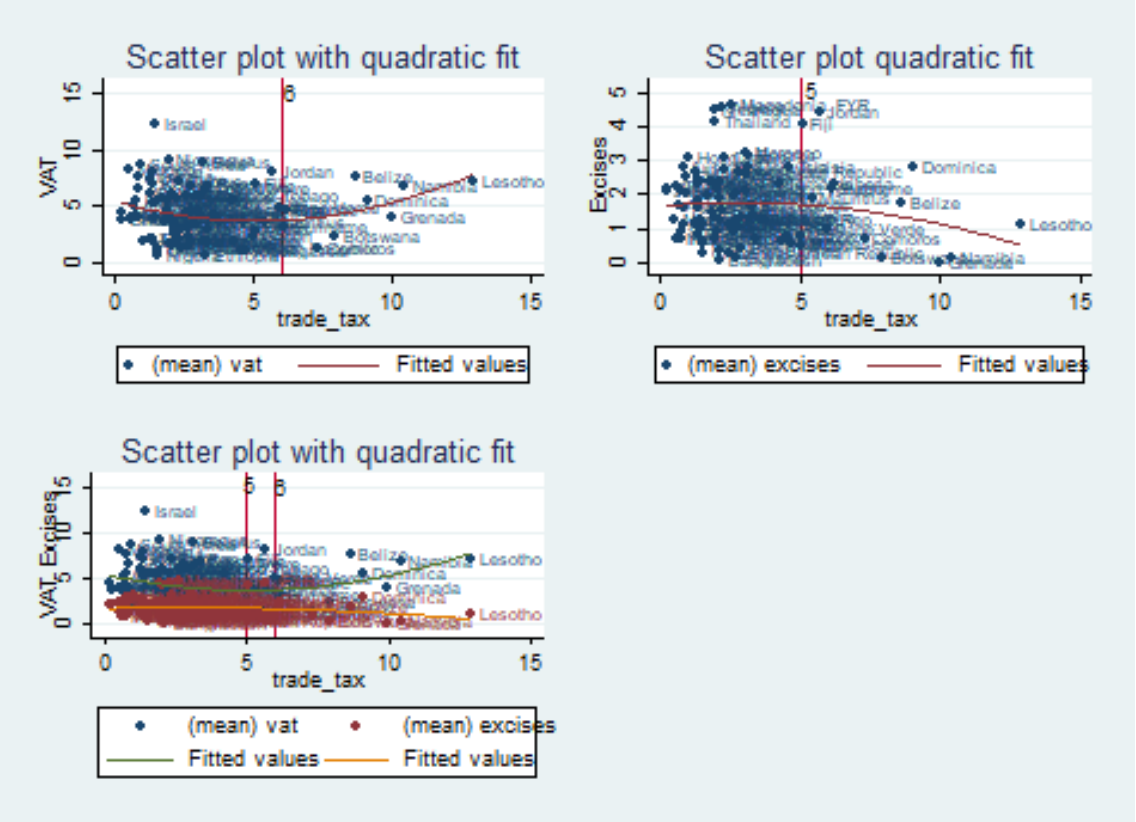
Appendix 2 : List of countries and VAT adoption date

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
Armenia	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	India	2005
RCA	2001	Sri Lanka	1998	Thailand	1992	Nepal	1997
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	Barbados	1997
Fiji	1992	Malaysia	1980	Mexico	1980	Kazakhstan	1992
Georgia	1992	Namibia	2000	Paraguay	1993	Suriname	1999

Appendix 3 : Descriptive 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
Corruption	2880	2.596534	1.055766	0	6	2	2.5	3
Bureaucracy	2880	1.677457	1.032669	0	4	1	2	2
Aid	2488	7.192796	9.550847	.675395	94.94603	.7287161	4.010163	10.35916
Remittances	2389	4.514519	12.85716	.0000289	235.9241	.339055	1.56149	4.715458

Appendix 4 : Scatter plot



Chapter 2

Are incomes and property taxes effective instruments for tax transition?

Abstract

This paper investigates second wave tax transition(transfer of tax pressure from border taxation towards domestic taxation) concerns in developing countries. It essentially focuses on the compensation effects of incomes and property taxes over international trade tax revenue losses in developing countries. Using a generalized method of moment estimator, we come to the evidence that incomes and property taxes are poor instruments to balance trade tax revenue losses of trade liberalization in these countries. However, a mediating effect of financial development in the compensation nexus driven by corporate income taxes was found. We explain this result by the fact that the use of financial sector generates paper trails to government in order to enforce and raise corporate income taxes. Financial development may progressively crowd-out informal sector and leads to business formalization. Surprising, we do not find any mediating effect of financial development in the compensation patterns with personal income taxes. Nevertheless, some heterogeneities were discovered. Financial development mediates the compensation patterns of personal income taxes in Latin American countries, while the effect holds on corporate income taxes in African countries. We conclude the paper by highlighting the important role of financial development in second generation tax transition concerns over developing countries.

Keywords :Income taxes, Property tax, Tax transition, Developing countries.

2.1 Introduction

Improving domestic resource mobilization is an essential concern of the policy framework that actually need developing countries in order to face important challenges of economic globalization. Several studies that assess the effect of trade liberalization on public finance come to the striking evidence of a revenue loss effect of trade liberalization especially trade tax revenue losses (Bevan, 1995; Khattry & Rao, 2002; Keen & Ligthart, 2002b; Keen & Simone, 2004). The corollary of the trade liberalization policy framework implemented in developing countries in adherence to the World Bank and World Trade Organization policies guidelines is that, countries must promote trade, but alternatively find other tools of revenue mobilization to offset government revenue losses long dominated by international trade taxes.

In the first wave tax transition agenda, they must manage an efficient Value Added Tax (VAT) to offset trade tax revenue losses, while at the same time prepare the ground for a second generation tax transition concerns based on direct taxes (Chambas, 2005b).

Direct taxes revenue mobilization features come to prominence in the public debate, especially with the increased awareness of their relatively low amounts in total revenue collection. Tax revenues from incomes have yielded very little revenue in developing countries. Personal income tax which averages 25% of total tax revenue (over 7% of GDP) for developed countries, represents only 9% of tax revenue(less than 2% of GDP) for the developing ones (R. M. Bird & Zolt, 2005). Not only is income from persons not sufficiently collected but much income from corporates also escapes taxation through greater tax avoidance practices (Crivelli et al., 2016;Johannesen et al., 2016;Silberztein, 2009;Fuest et al., 2011; Janskỳ & Prats, 2015;Fuest & Riedel, 2010). And, despite property taxation is less subject to tax base competition, their lack of interest lies in the greater government administrative costs that make property tax a losing proposition in terms of revenue yields per expenditure of administrative costs(Bahl & Martinez-Vazquez, 2007).

Still, many developing countries continue to rely on free trade areas to boost trade and grant important tariff reductions, while the lack of public revenue would certainly impede the provision of public goods. Thus, it seems important to investigate whether trade tax revenue losses are offset with domestic revenue mobilization with a focus on incomes and property taxes (direct taxes) in this paper. As important as the question seems, there is actually no empirical assessment of the extent to which countries have succeeded in offsetting reductions in trade tax revenues by increased revenues from direct taxes (second generation tax transition goals). Baunsgaard and Keen (2010) try to assess the effect, but on their part focus on total domestic revenue mobilization. The role that particular tools of domestic revenue played in the transition process of developing countries, is an under-investigated area of the literature.

What role have direct taxes played, or could they play in the transition process of developing countries is an unanswered empirical question.

The aim of this paper is to make such an assessment and to provide additional reflexions on how to make direct taxes operational in second-generation tax transition concerns in developing countries.

The paper will follow the ongoing structure: section 2 provides a deep understanding of the tax transition concept and the paper focuses later on the compensation features of tax transition in our empirical framework. In section 3, the paper provides some stylized facts about tax transition concerns by incomes and property taxes in developing countries. Section 4 identifies important challenges faced by incomes and property taxes as revenue- raising instruments in developing countries. Section 5 tends to shed light on the role of financial development and digital improvements as mediating tools in order to raise more direct tax revenues. An empirical framework (section 6) lays the basis for identification of the compensation effects of incomes and property taxes, followed in section 7 by results and sensitivity analyses in section 8.

2.2 Refining the concept of tax transition

.

Tax transition is a concept that covers a multidimensional area of meaning. Yet, in the weak hypothesis, it refers to the balancing role of international trade taxes through increases in domestic revenue (Baunsgaard & Keen, 2010). This definition implies a change in the composition of government revenue with now an increased reliance on domestic tax revenues in order to offset international trade liberalization revenue losses (substitution effect over their seigniorage tax).

On the stronger hypothesis, tax transition adds additional conditions that consist in reducing the social cost of public revenue, transforming progressively the tax system (equity, transparency, liability and tax morale) for maintaining an appropriate level of tax revenue (Chambas, 2005b). While the interest with VAT is to raise more revenue, for income taxes the need is to enhance equity, liability and tax morale as a primary goal, and raise revenue next.

To sum, our definition of tax transition under the weak hypothesis implies a balancing aspect of international trade tax revenue made possible through increases in domestic revenue. But under the stronger one, while balancing trade tax revenue losses by increased revenue mobilization with domestic tax revenue, countries must also maintain an adequate level of overall tax revenue by enhancing tax compliance, equity and transparency.

Table 2.1: Major tax transition tools: key attributes

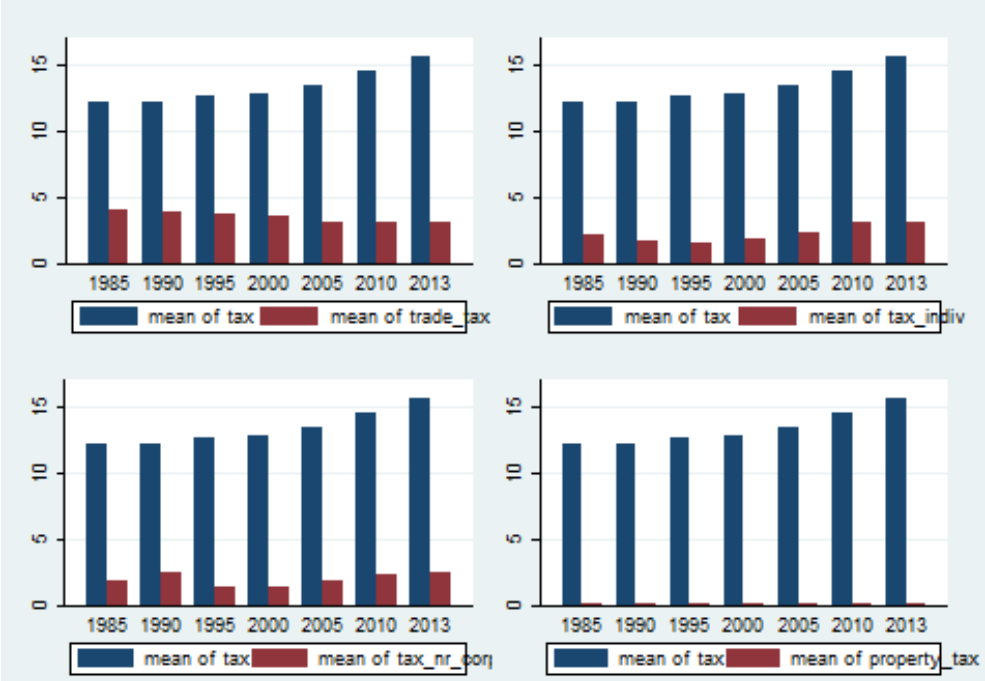
Tax	Equity	Liability	Transparency	Tax compliance	Revenue power
VAT	×	×	×	×	✓
Excises	×	×	×	×	✓
Personal income tax	✓	✓	×	×	×
Corporate income tax	✓	✓	×	×	×
Property tax	✓	✓	×	×	×

2.3 Tax transition with incomes and property taxes: Stylized facts

In this section, we aim at providing some basic graphs, in order to draw potential conclusions on tax transition features by incomes and property taxes in developing countries.

Graph1 : Total tax, trade tax, individual, corporate and property tax (% of GDP).

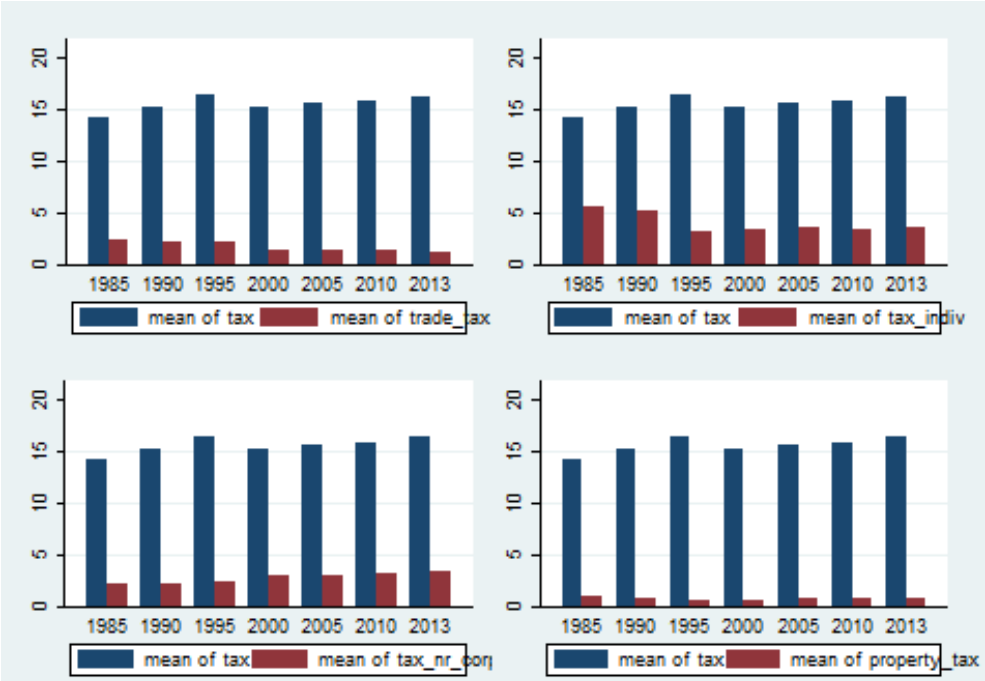
Sub-Saharan African countries.



Source : Author with ICTD data.

Graph2 : Total tax, trade tax, individual, corporate and property tax (% of GDP).

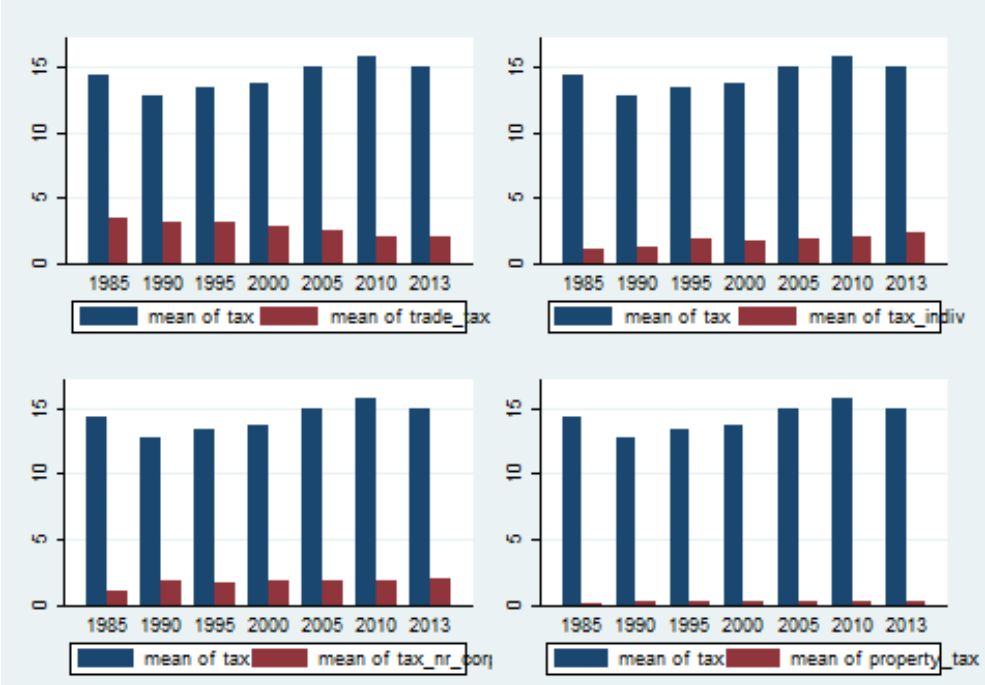
Asian countries.



Source : Author with ICTD data.

Graph3 : Total tax, trade tax, individual, corporate and property tax (% of GDP).

Latin American countries.



Source : Author with ICTD data.

Some conclusions can be made from these graphs. First, whatever the region considered in graph 1, graph 2, or graph 3, we observe a certain downward contribution of international trade tax revenue in developing countries (formerly seigniorage tax in these countries). On the whole, this tax has decreased in either African, Asian, or Latin American countries. Sub-Saharan African countries are however, the most dependent on international trade tax revenue as compared to

other countries.

Second, in African countries, we observe a slight increase in personal and corporate income taxes over the years 2000 to 2013. In Asian and Latin American countries, we rather observe a constant tendency of these taxes over the same period. But overall, there is no remarkable clear growing trend in income taxes in all regions, that could envisage any compensation effect of these taxes over international trade taxes. But this conclusion can be nuanced considering the above disparities observed across regions.

Finally, a third major recognition is the poor contribution of property tax to total tax revenue mobilization in these countries. Despite property taxation being less subject to tax base competition, it lacks interest in developing countries mainly due to high administrative costs in enforcing property taxation. This makes property tax a losing proposition in terms of revenue mobilization per expenditure of administrative costs(Bahl & Martinez-Vazquez, 2007).

Overall, it can be suspected that, incomes and property taxes couldn't act as valuable tax transition tools in developing countries.

2.4 Identify challenges to incomes and property taxes as tax transition tools in developing countries

2.4.1 Incomes taxes

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Any tax discussion in developing countries must take into account the economic structure of these countries that includes two kinds of taxpayers : the large agriculture sector encountered, and the prominence of the underground economy (V. Tanzi & Zee, 2000a). Taxing these sectors raises substantial practical difficulties in terms of enforcement and revenue mobilization (Alm, Martinez-Vazquez, & Wallace, 2005; Spiro, 2018; Feige, 2007). The tax base potentially reachable in such circumstances constitutes a smaller portion of total economic activities than in developed countries (R. M. Bird et al., 2004). Economic development, particularly the increase in the number of medium and large enterprises, and the shift from subsistence agriculture to manufacturing sectors and formal services, will make it easier to tax incomes in these countries (R. M. Bird & Zolt, 2005).

2.4.1.1 Personal income taxes

Mobilizing personal income tax revenue in developing countries is something more puzzling. Still, in many developing countries, the proportion of workforce addicted to the modern economy especially from the public and private sector is relatively small. Such limited part of the

working population is the main contributor of the personal income tax, by the withholding regime on wages, while many times, tax authorities are unable to observe, enforce and tax their business incomes or self-employment incomes (Alm, Bahl, & Murray, 1991). In the unrecorded economy, many employees have no formal contract and their employers are unknown to tax authorities(Chambas, 2005a). Substantial part of individuals are not taxed on their business(es) or self-employment incomes because of the lack of enforcement methods (Gordon & Li, 2009). These business incomes come from commercial, independent and liberal activities (lawyers, accountants, doctors, e.t.c). The revenue potential that could be derived from these types of activities is insufficiently collected because of lack of information to tax authorities. Unfortunately, even though an increasing part of the upper-middle and wealthy class receive reasonable rental incomes from property, these forms of revenue largely escape taxation, except if it is paid by a corporation where we can imagine a withholding regime as with income from interests and dividends. Nevertheless, an increased part of these incomes are cash paid by individuals to owners unknown to tax authorities (Chambas, 2005a).

2.4.1.2 Corporate income taxes

Corporate taxation also raises substantial challenges in developing countries, and more closely while considering globalization aspects. Primarily, in the modern economy, corporates that establish effective accounting for taxation are limited (Chambas, 2005a). Not only effective accounting, but also the incoherent design of the accounting rules (V. Tanzi & Zee, 2000a). According to V. Tanzi and Zee (2000a) allowable depreciation of physical assets is one of the most structural element in determining CIT[1] and corporate profitability. Frequently, countries have depreciation systems that are complex, incoherent and not tax-friendly (V. Tanzi & Zee, 2000a). These include (i) excessive number of depreciation rates, (ii)excessive number of asset categories, (iii) a structure of depreciation rates that is not in accordance with the relative obsolescence of assets categories. Rectifying these shortcomings would certainly simplify bookkeeping requirements (V. Tanzi & Zee, 2000a). Yet, due to the weak administrative capacity of their tax authorities to audit and control taxpayers, tax base is poorly contained (Chambas, 2005a). Frequently, due to the low threshold of adopted turnover, tax administration files are crowded with many small corporate activities. Unfortunately, only a few large companies concentrate the essential of corporate tax revenue and are also sensitive to the evolution of commodities price shocks (Chambas, 2005a).

On another hand, globalization also affects corporate tax revenue through greater tax avoidance practices (transfer pricing methods, profit shifting) by powerful multinationals, and this con-

[1] Corporate income tax

cern raises important challenges for these countries with weak administrative capacity to control these escape patterns. This view is confirmed by several studies. For example, Crivelli et al. (2016) found that, tax base spillovers are a significant concern for developing countries than for advanced economies. Their paper evidenced cross border tax plannings in developing countries in response to cuts in abroad tax rates (operating mainly through profit-shifting), while for developed countries the response is most time through tax competition. Johannesen et al. (2016) find solid empirical evidence that multinational firms reduce considerably their tax bill by shifting profits from high corporate tax affiliates to low ones, in their intra-group activities. This occurs through mispriced goods and services (transfer prices) or through financial assets. Income-generating financial assets are allocated through low tax affiliates, whereas cost generating liabilities (internal and external debts) are allocated through high tax affiliates. Later result is also confirmed by Fuest et al. (2011) who find positive relationship between host country corporate tax rate and debt ratio of multinational affiliates in developing countries. The global loss of government revenue caused by profit shifting is counted in hundreds of billions and has been increasing over time (Johannesen et al., 2016).

2.4.2 Property tax

2.4.2.1 Foundations of property taxation

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Property taxation presents some benefits. It has the neutral property that affects a bit of taxpayers' economic behaviors. It constitutes an equitable tax whose perception is closely related to wealth. The immovable nature of the tax base makes property taxation less open to tax base competition. Rapid urbanization of cities is an argument in favor of property taxation that makes it possible to establish a link between the demand for public goods and local taxes (Chambas, 2005a).

2.4.2.2 Property taxation: related challenges

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Despite its obvious nature, property tax in developing countries is difficult to implement due to the administrative costs of collecting tax with respect to the revenue yielded. Thus, tax administration with weak administrative capacity is reticent to engage in property taxation. According to Kelly (2000) a major obstacle of property taxation in less developed countries is tax administration, in implementing basic administrative procedures to improve the coverage

and valuation techniques. The absence of property registry and property rights also represent a huge challenge (Chambas, 2005a). Finally, in developing countries, the mid-class considers property taxation unfair with respect to savings needed to obtain property, while the wealthy-class conflicts with property taxation because it reduces the return of their wealth (Chambas, 2005a).

2.5 Could financial development and digital improvements help bridge the gap in mobilizing direct tax revenues?

2.5.1 Conceptual framework of the impact of financial development on tax revenue

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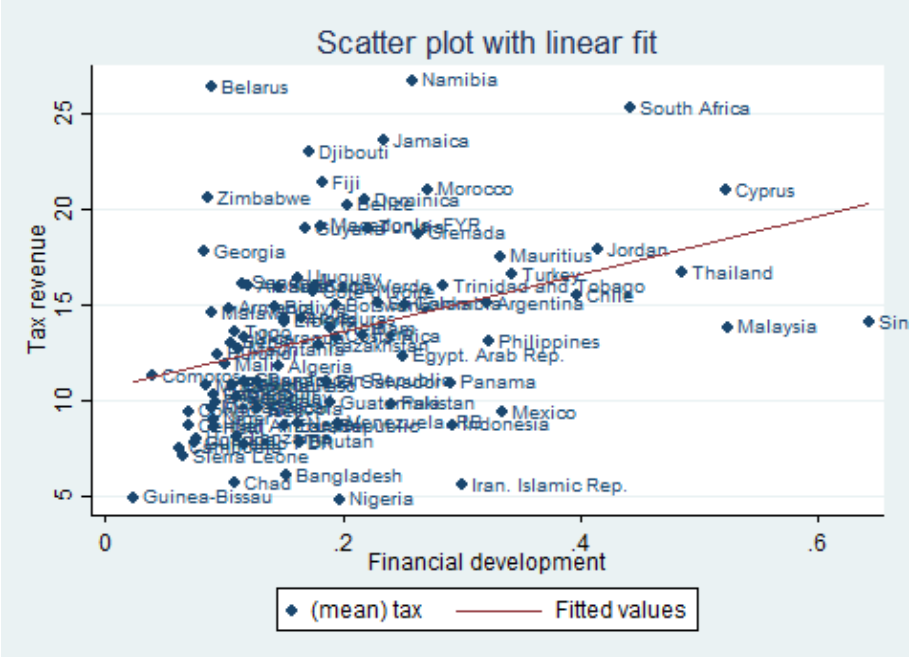
A major constraint for taxation in developing countries relies on the fact that tax administrations in these countries are unable to observe transactions in order to impose tax on them. Or they may observe them, but they lack enforcement methods in order to deal with these challenges. A growing literature therefore argues that understanding information flows is central for effective taxation (Pomeranz, 2015; Kosonen & Ropponen, 2015; Hondroyiannis & Papaoikonomou, 2017; Besley & Persson, 2014b; R. M. Bird & Zolt, 2008a; Kleven et al., 2016). The challenge of enforcing income taxes is particularly severe in developing countries, where many transactions in the economy are not readily observable by tax authorities (Besley & Persson, 2013; Gordon & Li, 2009). An emerging literature highlights the role of financial development on tax revenue nexus, as financial development acts as a source of information flows for tax authorities. Several arguments are put forward. One aspect of the argument outlined by Hondroyiannis and Papaoikonomou (2017) is the dematerializing effects of financial development. As tax avoidance is often facilitated by cash transactions, efficient financial tools such as checks and cards are likely to increase the probability of detection, leading to greater tax compliance. The new agenda for tax reform in developing countries prescribes a broad tax base, with increased reliance on income taxes. Thus, governments must be able to sufficiently monitor receipts of income, a complex puzzle in countries with opaque financial systems. Efficient income tax collection is obviously impossible if income is received and spent as cash. If, instead, a country has a robust, transparent, and widely used banking system, the government has a great facility to tax either incomes or purchases (Gilbert & Ilievski, 2016).

The ability of the financial sector to reveal and signal revenues, reduces information frictions on taxpayers' incomes and purchases, through financial institutions and financial markets (Ellul

et al., 2015). Improvements by way of better information by the financial sector also reduce firms' incentives to operate underground (Gilbert & Ilievski, 2016). As highlighted by Beck et al. (2014), financial development contributes to reduce firms' tax evasion, as access to finance is expensive for firms with greater tax avoidance practices (Hasan et al., 2014). More transparent firms are the ones that enjoy better access to finance (Ellul et al., 2015). This means, firms are more likely to under-report sales, in economies with underdeveloped financial markets because they gain little from being formal (Johnson et al., 2000). In addition, information related to corporate misconducts are easily observed in a well-developed financial system, and shared among all potential lenders, which will make it more difficult to evade taxes (Jappelli & Pagano, 2002). Capasso and Jappelli (2013) provide a theoretical framework that explains the relationship between financial development and corporate tax revenue. In their theoretical framework, agents allocate investments between a low-return technology which can be operated with internal funds, and a high-return technology which requires external finance. Firms can reduce the cost of funding by disclosing more assets and pledging them as collateral. They show that financial development increases the likelihood of firms to signal their assets and comply with tax obligations when they become more high-tech projects-depending.

The development of the financial sector plays an important role in acquiring information, enforcing contracts and making transactions (R. Levine, 2005). In conjunction with legal, regulatory tax systems R. Levine (2005), it facilitates tax enforcement but also direct collection of taxes (Bose et al., 2012; Capasso & Jappelli, 2013). Through the use of the financial sector, firms generate paper trails, facilitating tax enforcement (Gordon & Li, 2009).

Graph 4: Scatter plot between financial development and tax revenue.



2.5.2 Closing the technology gap and direct tax revenue mobilization

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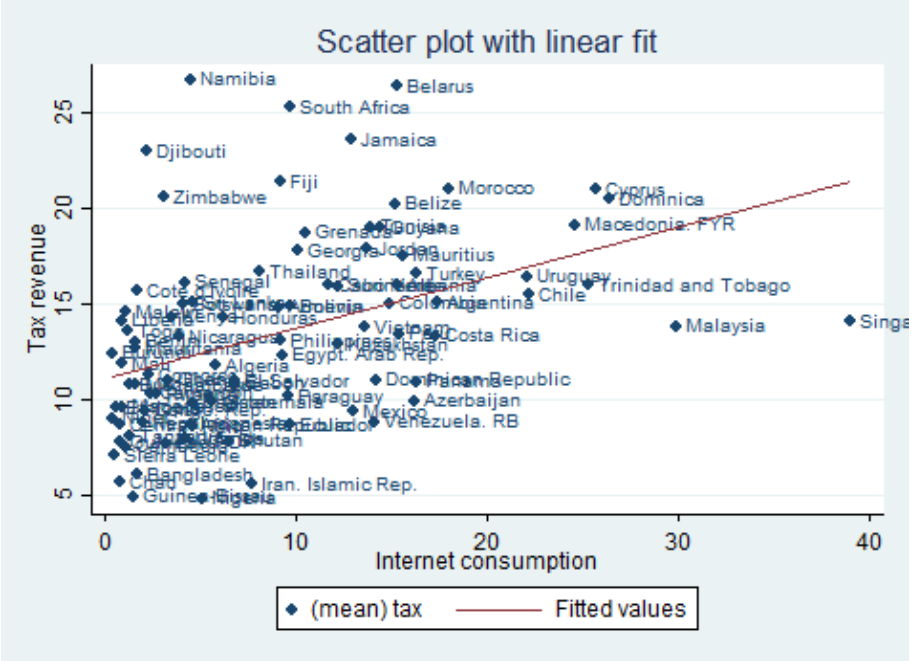
A promising path in developing countries is also to adopt various practices in tax administration in order to broaden tax bases. As highlighted by R. Bird (2010), no modern tax administration can perform its task efficiently without using modern information technology. Personal income tax, which is withheld at source could benefit from digitalization to manage declarations and payments online (Gnangnon & Brun, 2018). Digital improvements facilitate controls by the tax administration in order to broaden tax bases. Connecting tax administration softwares with large enterprises websites, would lead to better control of tax evasion (Gnangnon & Brun, 2018). Electronic filing methods of taxes e-tax (internet based or barcode[2] based tax filing methods) are important issues that automate tax processes in an attempt to improve efficiency in collecting tax information. They have the potential to improve tax-filing services and at the same time reducing compliance costs to taxpayers and tax agencies (Fu et al., 2006). Tax administrations increasingly need information technology expertise because some of their most important taxpayers (multinational firms) and large domestic firms, employ sophisticated computer systems that are beyond the investigative capacity of technologically backward tax administrations (R. Bird, 2010). Advances in information technology (IT) also offer a cheaper possibility for gathering and analyzing a large amount of firms' data (data processing). It serves to monitor earning information and improve tax capacities(Ali et al., 2015). A deep analysis of technology and taxation is provided by R. M. Bird and Zolt (2008b) emphasizing the fact that, tax administration in developing countries must move from hand to mouse to improve enforcement, auditing process and collection ratios.

[2]A review of these tax filing methods are given in (Fu et al., 2006). While internet filing method simplifies the expedition of tax-filing process, barcode works like a paper disk which contains machine-readable information to help tax administration quickly feed tax information forms into the agency's information system through a scanner. eTax eliminates manual entry errors by taxpayers and provides tax agency with a cleaner information of income tax returns.

Graph 5: Scatter plot between internet consumption and tax revenue.



2.6 Empirical framework

2.6.1 Model specification and econometric strategy

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We essentially investigate in this paper the compensation aspects of incomes and property taxes over international trade tax revenue losses in developing countries. Is there any change in the composition of government revenue that helps compensate for international trade taxes with incomes and property taxes? We start by presenting the following dynamic empirical specification as our first identification strategy (Baunsgaard & Keen, 2010).

Equation 1 : Compensatory effect model

$$Y_{it} = \beta_0 + \beta_1 * Y_{it-1} + \beta_2 * trade\_tax_{it} + \beta_3 * X_{it} + \mu_i + \xi_{it} \tag{2.1}$$

Where Y is a matrix of dependent variables (PIT[3], CIT[4] PT[5]), and trade tax (TT[6]) is the variable of international trade tax revenues. We add this variable in the model to investigate for movements in PIT, CIT, and PT depending on movements in trade tax that help study compensation effects. We are interested in the coefficient β_2. If this coefficient points negative, it indicates a compensatory effect of incomes and property taxes over international trade tax revenue losses. Our sample covers 96 developing countries spanning the period 1985-2013. We

[3]Personal income tax
[4]Corporate Income Tax
[5]Property tax
[6]Trade tax

have an unbalanced panel data over this period due to the poor coverage of some revenue data. We control for the lagged value of the dependent variable to take into account inertia in tax revenue mobilization in developing countries. X is the matrix of control variables and μ_i the unobserved heterogeneity time-invariant related to countries that explains their revenue patterns. ξ_{it}, the idiosyncratic error term.

Yet, it must be stressed that, the impact effect of trade liberalization on our variable of trade taxes, and further of trade taxes on our variable of domestic taxes is conceptually endogenous. First, even if first steps of trade liberalization may follow an exogenous change in trade tax instruments dictated by participation in multilateral negotiations, further steps of the liberalization process consisting in removing high tariffs, quotas and exemptions, consolidating level of tariffs, and improving custom administrations and custom procedures are intrinsic to each country and endogenously affect its trade tax revenues. Second, the extent to which a country optimally compensates lost of trade tax revenues with domestic taxes depends on the way it is easy or not for this country to collect domestic revenues in the face of tariff cuts, for example. The result is that there would be a simultaneity in the relationship that goes from trade taxes to domestic taxes in our matrix of Y. Intuitively by constraining the way direct taxes can be raised, collection or compliance costs may indirectly affect further reliance on trade taxes for example.

Still, referring also to our lagged dependent variables, estimating our equation using a fixed-effect model would lead our results to suffer from Nickell bias (Nickell, 1981). According to all these, and in order to deal with the endogeneity of trade taxes, we perform system Generalized Method of Moment GMM estimation Blundell and Bond (1998) with Windmeijer (2005) finite sample correction of standard errors. System GMM combines in one system the regression in differences Arellano and Bond (1991) and the regression in levels (Arellano & Bover, 1995). Differences equations are instrumented with instruments in levels and level equations are instrumented with instruments in differences. Based on generalized method of moments, our preferred identification strategy is to add external instruments to our moment conditions. We add two external instruments: the adherence of countries to World Trade Organization (WTO) policies guidelines, and their trade tax effective rate in a GMM-IV rationale estimate. The idea behind trade tax effective rate is to capture the extent of trade liberalization on trade tax revenue. For the adherence to WTO guidelines, this instrument is added to the model to capture the choice to comply with an external policy guideline on trade tax revenues. We hypothesize that the adherence to WTO has any chance to affect local taxes (property tax, individual income tax or corporate income tax) and the level of trade tax effective rate is closely related to trade tax revenue but not property tax or individual income tax.

The overidentification test proposed by Hansen (1982) and the autocorrelation test of Arellano and Bond (1991) are used to confirm the validity of the external and internal instruments.

2.6.2 Data and variables

2.6.2.1 Dependent variables

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Dependent variables of PIT, CIT and PT come from International Centre for Tax and Development (ICTD, 2018). All variables are expressed non-resource and in percentage of GDP.

2.6.2.2 Independent variables

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Explanatory variables include trade tax revenue. This variable comes from International Centre for Tax and Development (ICTD, 2018) database. As said earlier, we add this variable in the model to investigate for movements in PIT, CIT, and PT depending on movements in trade tax that help study compensation effects. In equation 1, we use covariates data (i) GDP per capita, (ii) trade openness in percentage of GDP, (iii) natural resources rents in percentage of GDP, (iv) agriculture value added to GDP, (v) the level of corruption and (vi) the level of bureaucracy quality. These variables come from the World Development Indicators (WDI, 2018), except corruption and bureaucracy quality that come from International Country Risk Guide (ICRG). Per capita income is expected to be positively correlated with tax revenue. It expresses the overall level of economic development and the advanced design of tax structure. According to Wagner's law, the demand for governments services 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 revenue through several 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 improvements in custom procedures. Aizenman and Jinjarak (2009) also emphasize trade openness should shift tax revenue from "easy to collect taxes" (tariffs) towards "hard to collect taxes" (PIT, CIT and PT) suggesting its effect on tax transition concerns in developing countries.

Recent challenges in natural resources wealth countries, focused on the 'Dutch disease' effects. Natural resources might affect taxation 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 M. Moore (2007), argued that, governments relying on resources rents are likely to mobilize less revenue from the non-resource sector, and this result suggests that, resources rents lead to low domestic tax efforts and reduce tax revenue mobilization.

Agriculture sector is expected to be negatively correlated with tax revenue 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.

The literature suggests that corruption affect tax revenue by its effect on tax evasion (Attila et al., 2009). Indeed, Hindriks et al. (1999) stress that corruption and income tax evasion are closely linked. Corruption undermines tax morale and tends to increase the underground economy. This could have a negative effect on income taxes. But the effect could be mixed. In a high corrupt environment, the possibility of negotiating bribes between auditors and taxpayers may encourage controllers to increase fraud detection efforts. With time, fraud would become less attractive, and corruption would lead to increased tax revenue.

Finally, incentive reforms in tax administration, notably the internal organization of bureaucracies and organizational structure, positively affect revenue mobilization. Or on the other hand, the extent of discretion available to bureaucrats, and the underlying dimension of bureaucratic quality undermines revenue mobilization (Mookherjee, 1998).

2.7 Results

2.7.1 Baseline results

Table 2.2 reports results for the compensatory effects between PIT, CIT, PT and trade taxes (TT). We do not find any compensation role of these taxes on trade tax revenues. This is not surprising since incomes and property taxes represent a small proportion of revenue concerns in developing countries. Tax authorities in developing countries face substantial challenges in raising incomes and property taxes due on one hand, to administrative challenges they face (lack of enforcement methods), and on the other hand, to the economic structure of these countries with sizeable part of informality (activities conducted underground) and a large part of the agriculture sector. In such circumstances, tax base that can be optimally reached in total economic activities remains limited. Diversifying the economic activities will make it possible to tax incomes in these countries (R. M. Bird & Zolt, 2005).

Table 2.2: Compensation effect: PIT, CIT, PT, Baseline result

	(1)	(2)	(3)
	GMM-IV	GMM-IV	GMM-IV
VARIABLES	PIT	CIT	PT
L.PIT	0.842***		
	(0.0812)		
Trade tax	0.00643	-0.0200	-0.00633
	(0.0136)	(0.0214)	(0.00607)
Log(gdp capita)	0.142*	0.209**	0.108***
	(0.0760)	(0.0935)	(0.0291)
Agriculture	0.00549	0.000229	0.00284*
	(0.00350)	(0.00556)	(0.00171)
Trade	-1.40e-05	0.00571**	-0.000287
	(0.000976)	(0.00240)	(0.000368)
Natural resources	-0.00301	-0.00440	-0.00204
	(0.00340)	(0.00661)	(0.00175)
Corruption	0.0323	0.0299	0.0229
	(0.0333)	(0.0451)	(0.0143)
Bureaucracy quality	0.0912**	0.140*	0.0176
	(0.0402)	(0.0719)	(0.0193)
L.CIT		0.424***	
		(0.113)	
L.PT			0.585***
			(0.0832)
Constant	-1.103*	-1.060	-0.815***
	(0.599)	(0.663)	(0.250)
Observations	1,635	1,442	1,726
Number of country__code	91	82	88
Ar2	-0.823	1.206	-0.0802
Ar2p	0.411	0.228	0.936
Hansen	57.02	57.67	58.30
Hansenp	0.437	0.413	0.391
Ar1	-2.849	-1.671	-2.864
Ar1p	0.00439	0.0948	0.00418

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

2.7.2 Taking into account financial development and digital improvements

.

Now, we aim to test for two main mediators that can help raise tax enforcement and tax revenue collection in developing countries, namely financial development and internet consumption.
Financial development plays an important role in acquiring information on taxpayers' incomes through financial institutions and financial markets. It facilitates tax enforcement, the collection of tax, and helps crowd-out shadow economy. It also generates paper trails for firms with greater tax avoidance practices, thus limiting tax evasion.
Improving digital tools such as the internet consumption ratio will allow for smart policies in tax administration. It will help manage declarations and payments online, automates tax processes to eliminate manual entry errors and provides tax agency with cleaner information on income tax returns.

We re-estimate the following empirical model that helps study the mediating effect of these instruments on the compensation patterns in developing countries.

$$Y_{it} = \beta_0 + \beta_1 * Y_{it-1} + \beta_2 * trade\_tax_{it} + \beta_3 * Z_{it} + \beta_4 * trade\_tax_{it} * Z_{it} + \beta_5 * X_{it} + \mu_i + \xi_{it} \quad (2.2)$$

where Z is a matrix of variables (financial development, internet consumption ratio). Our variable of financial development is a composite index that covers multidimensional areas of financial development and expresses a country's overall level of financial development ranged between [0 1], with greater value implying more developed financial systems. It was introduced by the International Monetary Fund Strategy Policy and Review Department constructed from various indicators of financial systems[7]. The internet consumption variable comes from World Development Indicators (2018). We are interested in the coefficient β_4. Results are given in table 2.3.

We do not find any mediating effect of financial development on personal income tax revenue compensation patterns in developing countries, but financial development made it possible to compensate for revenue losses with corporate income taxes. This result is given in column 3 of table 2.3. It seems like financial development is helping to crowd-out shadow economy and leads to business formalization in these countries. But our result rather points out a threshold effect. The estimated threshold is 18%. Countries with financial development at least above 18% are those in which the beneficial effect of financial development on corporate tax revenue may materialize.

Finally, we do not find any mediating effect by the internet consumption ratio with all taxes (PIT, CIT, PT). Digitalization is a recent phenomenon that takes place in tax administration in developing countries. This can help understand the non-effect of the internet variable on the compensation patterns of developing countries.

[7]The database is available at http://data.imf.org/?sk=F8032E80-B36C-43B1-AC26-493C5B1CD33B.

Table 2.3: The mediating effect of financial development and digital improvements

VARIABLES	(1) GMM-IV PIT	(2) GMM-IV PIT	(3) GMM-IV CIT	(4) GMM-IV CIT	(5) GMM-IV PT	(6) GMM-IV PT
L.PIT	0.824***	0.774***				
	(0.0782)	(0.106)				
Trade tax	0.00355	0.00620	0.0987*	0.00674	0.00896	-0.00394
	(0.0290)	(0.0220)	(0.0549)	(0.0248)	(0.0109)	(0.00715)
Log(gdp capita)	0.0940	0.140	-0.0267	0.0525	0.0927***	0.112***
	(0.0677)	(0.0899)	(0.0947)	(0.101)	(0.0270)	(0.0328)
Agriculture	0.00395	0.00612	-0.00469	0.00268	0.00240*	0.00381**
	(0.00394)	(0.00544)	(0.00530)	(0.00704)	(0.00126)	(0.00185)
Trade	7.45e-05	-0.000554	0.00607**	0.00370	-0.000332	-0.000330
	(0.000967)	(0.00136)	(0.00256)	(0.00305)	(0.000298)	(0.000301)
Natural resources	-0.00486	-0.00640	-0.00261	-0.00200	-0.00201	-0.00208
	(0.00328)	(0.00453)	(0.00606)	(0.00892)	(0.00175)	(0.00181)
Corruption	0.0231	0.0246	0.00471	0.0196	0.0259**	0.0278**
	(0.0319)	(0.0458)	(0.0390)	(0.0509)	(0.0101)	(0.0122)
Bureaucracy quality	0.0731*	0.104	0.120**	0.174	0.00761	0.00672
	(0.0393)	(0.0660)	(0.0596)	(0.113)	(0.0129)	(0.0187)
FD	0.618		2.561***		0.285**	
	(0.452)		(0.702)		(0.132)	
Trade tax*FD	-0.0191		-0.538*		-0.0735	
	(0.151)		(0.277)		(0.0478)	
Internet ratio		0.00304		0.00758		0.000909
		(0.00212)		(0.00535)		(0.000689)
Trade tax*Internet		0.00104		-0.000617		5.28e-06
		(0.000868)		(0.00159)		(0.000295)
L.CIT			0.454***	0.583**		
			(0.101)	(0.243)		
L.PT					0.608***	0.643***
					(0.0858)	(0.0914)
Constant	-0.732	-0.999	0.169	-0.317	-0.740***	-0.878***
	(0.581)	(0.747)	(0.682)	(0.704)	(0.211)	(0.269)
Observations	1,635	1,303	1,442	1,141	1,726	1,364
Number of country__code	91	90	82	81	88	88
Ar2	-0.821	-0.985	1.252	-1.079	-0.0501	-0.909
Ar2p	0.412	0.324	0.211	0.281	0.960	0.363
Hansen	29.10	23.39	28.99	10.16	32.10	40.91
Hansenp	0.460	0.758	0.466	0.118	0.315	0.110
Ar1	-2.871	-2.527	-1.746	-2.156	-2.992	-2.502
Ar1p	0.00409	0.0115	0.0808	0.0311	0.00277	0.0124

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

2.8 Sensitivity analyses

2.8.1 Non linearities

Our first baseline estimate was conducted without taking into account possible nonlinear specification in the compensation patterns between PIT, CIT, PT and TT. Our main assumption here, is to investigate whether there is a compensation effect that takes place when the decrease in TT becomes more important. As said, we want to investigate whether tax administrations are forced to implement sound fiscal policies[8] to raise the level of direct taxes when there is a more pronounced decline in TT. Hence, we include in the model the square term of TTR[9].

[8]These policies may for example concern policies to fight against tax evasion and collect back taxes.

[9]Trade tax revenue

Basically, we re-estimate the following model:

$$Y_{it} = \beta_0 + \beta_1 * Y_{it-1} + \beta_2 * trade\_tax_{it} + \beta_3 * trade\_tax^2it + \beta_4 * X_{it} + \mu_i + \xi_{it} \quad (2.3)$$

Results are given in table 2.4. We do not find any compensation effect that takes place because of a more pronounced decline in TTR. This result confirms the fact that direct taxes revenue mobilization in developing countries are still limited to accommodate for any shock in TT revenue and are not yet serving as valuable tax transition instruments in developing countries.

Table 2.4: Non linearities

	(1)	(2)	(3)
	GMM-IV	GMM-IV	GMM-IV
VARIABLES	PIT	CIT	PT
L.PIT	0.864***		
	(0.0780)		
Trade tax	-0.0329	0.0317	-0.00726
	(0.0387)	(0.0693)	(0.0172)
Trade tax^2	0.00327	-0.00330	0.000316
	(0.00387)	(0.00572)	(0.00139)
Log(gdp capita)	0.119	0.182*	0.133***
	(0.0795)	(0.0946)	(0.0318)
Agriculture	0.00455	0.00406	0.00347*
	(0.00379)	(0.00734)	(0.00190)
Trade	0.000509	0.00430*	-0.000621
	(0.000966)	(0.00256)	(0.000481)
Natural resources	-0.00494	-0.00584	-0.00129
	(0.00354)	(0.00792)	(0.00197)
Corruption	0.0116	-0.0123	0.0339**
	(0.0307)	(0.0437)	(0.0136)
Bureaucracy quality	0.0749	0.183**	0.0170
	(0.0464)	(0.0798)	(0.0173)
L.CIT		0.487***	
		(0.116)	
L.PT			0.558***
			(0.0905)
Constant	-0.841	-1.069	-1.010***
	(0.611)	(0.789)	(0.280)
Observations	1,635	1,442	1,726
Number of country_code	91	82	88
Ar2	-0.830	1.375	-0.120
Ar2p	0.406	0.169	0.904
Hansen	22.22	25.31	22.89
Hansenp	0.387	0.234	0.350
Ar1	-2.981	-1.879	-2.901
Ar1p	0.00288	0.0602	0.00372

Standard errors in parentheses

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

2.8.2 Improving the identification strategy: investigating for asymmetries

.

In this section, we aim to improve the standard framework for identifying the compensation effect between PIT, CIT, PT and TT. Instead of regressing the level of direct taxes (PIT, CIT, PT) on TT, we regress the variation of these taxes on the variations of TT. This is done by taking the first difference of variables in the model and identify the episodes of effective decrease in trade tax revenues as compared to episodes of increase in this tax that we call "asymmetries". We then regress the variations of PIT, CIT and PT on negative variations of TT and on positive variations of this tax. Results are given in table 2.5 and table 2.6.

No evidence was found suggesting that it is better to specify our model in variations to improve the identification strategy. We still find robust results suggesting that incomes and property taxes do not compensate for TTR losses in developing countries, except the beneficial effect of financial development found in equation 2.

Table 2.5: Investigating for asymmetries: negative shocks

	(1)	(2)	(3)
	GMM-IV	GMM-IV	GMM-IV
VARIABLES	ΔPIT	ΔCIT	ΔPT
L.ΔPIT	0.0983**		
	(0.0454)		
Δtrade tax(-)	-0.0703	0.0813**	-0.00238
	(0.0503)	(0.0345)	(0.00786)
ΔLog(gdp capita)	-0.00349	0.150	-0.0913
	(0.395)	(0.537)	(0.153)
ΔAgriculture	-0.00549	-0.00260	-0.000624
	(0.00421)	(0.00784)	(0.00122)
ΔTrade	0.00215	0.00310	-0.000554
	(0.00150)	(0.00379)	(0.000540)
ΔNatural resources	-0.0105**	0.00230	-0.00375
	(0.00534)	(0.00796)	(0.00234)
ΔCorruption	0.00462	-0.0639	0.0335**
	(0.0333)	(0.0603)	(0.0163)
ΔBureaucracy quality	0.0365	-0.0564	0.0278
	(0.0495)	(0.0699)	(0.0236)
L.ΔCIT		0.000580	
		(0.190)	
L.ΔPT			-0.230***
			(0.0590)
Constant	-0.00222	0.0511*	0.000163
	(0.0258)	(0.0289)	(0.00523)
Observations	859	762	912
Number of country_code	90	82	88
Ar2	0.308	-0.919	-0.759
Ar2p	0.758	0.358	0.448
Hansen	5.726	6.403	9.037
Hansenp	0.455	0.380	0.171
Ar1	-1.899	-2.139	-2.145
Ar1p	0.0576	0.0325	0.0319

Standard errors in parentheses

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

Table 2.6: Asymmetries: Positive shocks

VARIABLES	(1) GMM-IV ΔPIT	(2) GMM-IV ΔCIT	(3) GMM-IV ΔPT
L.ΔPIT	0.0934		
	(0.192)		
ΔTrade tax(+)	0.0752	-0.0119	-0.00607
	(0.0720)	(0.0988)	(0.0119)
ΔLog(gdp capita)	0.332	-0.908	-0.145
	(0.533)	(3.272)	(0.183)
ΔAgriculture	-0.0176**	-0.0202	-0.000629
	(0.00877)	(0.0140)	(0.00138)
ΔTrade	0.00254	0.0150*	0.000396
	(0.00157)	(0.00765)	(0.000918)
ΔNatural resources	-0.0105	-0.0228	-0.00383*
	(0.00711)	(0.0144)	(0.00197)
ΔCorruption	0.0437	0.151**	0.00563
	(0.0409)	(0.0634)	(0.00843)
ΔBureaucracy quality	-0.0347	0.218	-0.000843
	(0.0645)	(0.157)	(0.0203)
L.ΔCIT		-0.133**	
		(0.0517)	
L.ΔPT			-0.0988
			(0.0626)
Constant	-0.0146	0.0640	0.000901
	(0.0249)	(0.0978)	(0.00732)
Observations	663	580	703
Number of country_code	89	81	85
Ar2	0.326	1.082	1.316
Ar2p	0.745	0.279	0.188
Hansen	6.734	12.26	4.970
Hansenp	0.566	0.140	0.761
Ar1	-1.388	-1.081	-1.782
Ar1p	0.165	0.280	0.0747

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

2.8.3 Sub-sample heterogeneities

.

In our baseline estimate, we found that incomes and property taxes do not compensate for TTR losses, except the beneficial effect of financial development in equation 2. We aim to deepen the mediating effect of financial development focusing on several regions in the developing world. The main idea is that financial development varies widely across regions in the developing world. Financial development is relatively low in Sub-Saharan African countries in all indicators (institutions, markets) and all dimensions (access, depth, efficiency) as compared to other developing countries. The financial inclusion gap is also wide in this area of countries (Otchere et al., 2017). However, its marginal effect could be reinforced by its relatively stability to crisis (Otchere et al., 2017). Conversely, the high financial sector development in Asian and Latin American countries, in terms of depth, inclusion and access as compared to Sub-Saharan African countries, mostly goes together with disturbances (Heng et al., 2016). We make sensitivity analysis to ensure

that, financial development is effectively mediating tax revenue in the tax transition concerns over these areas of countries.

Results are given in table 2.7 for SSA countries, table 2.8 for Asian countries, and table 2.9 for LAC countries.

Contrary to what one might think, the level of financial development in SSA countries is mediating the compensation patterns in this area of countries. The effect is driven by corporate income taxes (CIT). One can think that the stability of the financial sector in SSA countries is at work in this area of countries even with a low level of financial parameters. The result is given in column 3 of table 2.7. Financial development is progressively crowding out informal sector in SSA countries leading to corporate formalization and corporate tax revenue. But we found a threshold effect in the mediating effect of financial development of 20%. This suggests that countries in SSA area with a financial sector development at least above 20% are the ones in which the mediating effect of financial development could materialize.

Our result also holds for property tax in column 5. Without financial development, countries cannot offset for revenue losses with this tax. As financial development increases, it leads to an increase in property tax that helps compensate for trade tax revenue losses. The reasonable idea behind this effect can be that, the use of the financial sector by property owners generates paper trails[10] to tax authorities that help enforce property taxation in SSA countries.

Replicating our estimate on Asian countries, we do not find any mediating effect of financial development on the compensation patterns with all taxes.

Finally, on the group of Latin American (LAC) countries, the mediating effect of financial development holds for personal income taxes. Our results are showing heterogeneous effects of financial development according to regions and according to type of tax. The result we obtain here could be explained by the advanced dematerializing effect of financial transactions in this area as compared to SSA countries. As personal income tax evasion is facilitated by cash transactions, efficient financial tools such as checks and cards are likely to increase the probability of detection, leading to greater personal income tax compliance. This can be a plausible explanation to the effect obtained with PIT in this area of countries. The advanced dematerializing effect of financial transactions made it possible to better monitor receipts of income in this area of countries. The result is provided in column 1 of table 2.9, where we find a threshold effect of 28%.

[10]The information may concern property registries

Table 2.7: Sub sample heterogeneities: SSA countries

VARIABLES	(1) GMM-IV PIT	(2) GMM-IV PIT	(3) GMM-IV CIT	(4) GMM-IV CIT	(5) GMM-IV PT	(6) GMM-IV PT
L.PIT	0.765***	0.717***				
	(0.114)	(0.156)				
Trade tax	-0.0235	-0.00880	0.148**	-0.00580	0.0176	-0.00336
	(0.0367)	(0.0448)	(0.0578)	(0.0624)	(0.0121)	(0.00705)
Log(gdp capita)	-0.0965	-0.0141	-0.0567	0.0540	-0.00965	0.0261
	(0.0975)	(0.163)	(0.119)	(0.220)	(0.0306)	(0.0416)
Agriculture	-0.00590	-0.00557	-0.00556	-0.00571	-0.00112	-0.00138
	(0.00605)	(0.00846)	(0.00515)	(0.0111)	(0.00103)	(0.00168)
Trade	0.00194	0.00244	0.00108	0.000135	-0.000567	-0.000185
	(0.00230)	(0.00425)	(0.00169)	(0.00515)	(0.000715)	(0.000842)
Natural resources	-0.00685	-0.00729	-0.00637	-0.00517	0.000179	0.000804
	(0.00428)	(0.00874)	(0.00596)	(0.0128)	(0.00148)	(0.00162)
Corruption	-0.102	-0.0744	-0.0654	-0.0230	0.000786	-0.00283
	(0.0875)	(0.125)	(0.0735)	(0.115)	(0.0147)	(0.0105)
Bureaucracy quality	0.0776	0.109	0.0792	0.273*	-0.00445	-0.00262
	(0.0527)	(0.0820)	(0.0892)	(0.162)	(0.0168)	(0.0114)
FD	1.930		5.878***		1.103*	
	(1.324)		(1.580)		(0.573)	
Trade tax*FD	0.175		-0.770***		-0.124*	
	(0.255)		(0.298)		(0.0717)	
Internet ratio		0.00827		0.0198		-0.00196
		(0.0210)		(0.0171)		(0.00354)
Trade tax*Internet		0.00766		0.00136		-0.000208
		(0.00756)		(0.00318)		(0.000821)
L.CIT			0.341***	0.279**		
			(0.0832)	(0.121)		
L.PT					0.512***	0.676***
					(0.110)	(0.0913)
Constant	1.109	0.736	0.752	0.664	0.0389	-0.0731
	(1.106)	(1.350)	(0.944)	(1.491)	(0.236)	(0.238)
Observations	615	454	529	387	556	409
Number of country_code	36	36	32	32	33	33
Ar2	-0.983	-1.036	0.839	-1.048	1.529	1.551
Ar2p	0.325	0.300	0.401	0.295	0.126	0.121
Hansen	3.920	7.743	6.764	7.872	13.68	8.051
Hansenp	0.561	0.258	0.748	0.641	0.188	0.328
Ar1	-1.753	-1.711	-1.914	-1.917	-2.301	-2.221
Ar1p	0.0820	0.0958	0.0625	0.0664	0.0214	0.0263

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.8: Sub sample heterogeneities: South East Pacific Asia

VARIABLES	(1) GMM-IV PIT	(2) GMM-IV PIT	(3) GMM-IV CIT	(4) GMM-IV CIT	(5) GMM-IV PT	(6) GMM-IV PT
L.PIT	0.950***	1.015***				
	(0.0500)	(0.0943)				
Trade tax	-0.0272	-0.0410	-0.00150	0.0215	0.0183	-0.000973
	(0.0259)	(0.0420)	(0.0861)	(0.0355)	(0.0221)	(0.0126)
Log(gdp capita)	0.0613	-0.0880	-0.0440	0.000293	0.0529	0.0531
	(0.113)	(0.242)	(0.0735)	(0.0825)	(0.0792)	(0.0461)
Agriculture	0.00226	-0.00353	-0.00544	-0.00439	-0.000190	0.00183
	(0.00277)	(0.0130)	(0.00551)	(0.00344)	(0.00121)	(0.00181)
Trade	-0.000148	0.00143	0.00132	0.00131	-0.000231	-0.000177
	(0.000542)	(0.00219)	(0.00201)	(0.000968)	(0.000285)	(0.000235)
Natural resources	-0.00515*	-0.00836	0.0107*	0.0161***	-0.00297	-0.00233
	(0.00312)	(0.00703)	(0.00637)	(0.00538)	(0.00261)	(0.00192)
Corruption	0.0228	0.0289	0.0276	0.0152	0.00609	0.00730
	(0.0286)	(0.0824)	(0.0397)	(0.0265)	(0.0139)	(0.0153)
Bureaucracy quality	-0.0170	-0.0512	0.0148	-0.00194	-0.00284	-0.00492
	(0.0193)	(0.0683)	(0.0550)	(0.0488)	(0.00964)	(0.0175)
FD	-0.0615		0.217		0.0157	
	(0.331)		(0.574)		(0.134)	
Trade tax*FD	0.0672		-0.0362		-0.120	
	(0.0772)		(0.310)		(0.128)	
Internet ratio		5.61e-05		0.00134		0.000531
		(0.00207)		(0.00212)		(0.000561)
Trade tax*Internet		-6.47e-05		-0.00152		-0.000189
		(0.00189)		(0.00150)		(0.000402)
L.CIT			0.949***	0.948***		
			(0.154)	(0.0887)		
L.PT					0.871***	0.871***
					(0.185)	(0.0764)
Constant	-0.353	0.766	0.349	0.0436	-0.316	-0.390
	(0.760)	(2.115)	(0.545)	(0.595)	(0.503)	(0.349)
Observations	474	392	445	369	496	403
Number of country__code	24	24	23	23	25	25
Ar2	-0.310	-0.225	0.188	-0.263	-1.116	-1.394
Ar2p	0.756	0.822	0.851	0.792	0.265	0.163
Hansen	2.636	3.566	8.364	7.890	7.466	10.25
Hansenp	0.756	0.613	0.213	0.246	0.280	0.115
Ar1	-2.149	-1.993	-2.046	-1.890	-2.060	-1.989
Ar1p	0.0316	0.0462	0.0408	0.0588	0.0394	0.0467

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.9: Sub sample heterogeneities: LAC countries

VARIABLES	(1) GMM-IV PIT	(2) GMM-IV PIT	(3) GMM-IV CIT	(4) GMM-IV CIT	(5) GMM-IV PT	(6) GMM-IV PT
L.PIT	0.695***	0.565***				
	(0.114)	(0.218)				
Trade tax	0.132*	0.0567	-0.0329	-0.0221	-0.0543	0.000387
	(0.0713)	(0.0709)	(0.0895)	(0.0985)	(0.0420)	(0.0150)
Log(gdp capita)	0.0566	-0.0403	-0.124	-0.0320	0.135	0.188
	(0.180)	(0.330)	(0.205)	(0.126)	(0.149)	(0.170)
Agriculture	-0.00751	-0.00755	-0.000263	0.00420	0.00743	0.0115
	(0.00982)	(0.0355)	(0.00955)	(0.0102)	(0.00820)	(0.0136)
Trade	0.00556***	0.00712	0.00591**	0.00417	-0.000264	-0.000667
	(0.00209)	(0.00724)	(0.00290)	(0.00388)	(0.00129)	(0.00235)
Natural resources	-0.0169*	-0.0340	-0.00608	-0.00705	-0.00388	-0.00317
	(0.00951)	(0.0256)	(0.0124)	(0.0146)	(0.00551)	(0.00873)
Corruption	0.00851	-0.0167	0.0251	0.0372	-0.00747	0.0205
	(0.0581)	(0.170)	(0.0579)	(0.0611)	(0.0254)	(0.0356)
Bureaucracy quality	0.105	0.333	0.0994**	0.113	0.0136	-0.0279
	(0.0748)	(0.232)	(0.0476)	(0.0812)	(0.0348)	(0.0539)
FD	1.261		0.536		-0.344	
	(0.931)		(2.020)		(0.654)	
Trade tax*FD	-0.470*		0.0741		0.254*	
	(0.255)		(0.369)		(0.143)	
Internet ratio		0.00731		-0.000506		0.000517
		(0.00674)		(0.00438)		(0.00187)
Trade tax*Internet		-5.72e-05		0.000499		0.000709
		(0.00207)		(0.000766)		(0.000483)
L.CIT			0.694***	0.727***		
			(0.152)	(0.189)		
L.PT					0.425***	0.376***
					(0.0556)	(0.101)
Constant	-0.851	-0.0842	0.860	0.195	-0.941	-1.546
	(1.449)	(2.910)	(1.498)	(1.139)	(1.184)	(1.431)
Observations	354	286	310	247	483	393
Number of country__code	22	21	20	19	22	22
Ar2	1.618	0.977	0.399	0.327	-0.887	-1.028
Ar2p	0.106	0.329	0.690	0.744	0.375	0.304
Hansen	8.122	9.055	5.807	6.357	3.558	6.949
Hansenp	0.522	0.170	0.445	0.384	0.615	0.542
Ar1	-1.709	-1.732	-2.362	-1.798	-1.789	-1.841
Ar1p	0.0875	0.0752	0.0182	0.0722	0.0612	0.0518

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

2.8.4 Adding more control variables

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In our baseline estimate, we mostly focus on variables that explain tax potential in developing countries as control variables, namely GDP per capita, agriculture ratio, trade openness, and natural resources. We also focus on institutional quality by adding the level of corruption and bureaucracy quality. In order to treat for possible "omitted" variable bias that can obscure the compensation effect of direct taxes, we add more control variables in the model. We control for the level of education, inflation and foreign aid. Kasipillai et al. (2003) document the effect of education on tax compliance behaviours and found that there is an improvement in personal income tax compliance among educated citizens.

Tanzi (1977) shows that when taxes are paid with a certain lag in tax collection, inflation may

erode the real value of tax bases leading to low tax revenue. For property and income taxes, the question is much more complex, as long as these taxes are paid on an annual rather than on a monthly basis (Tanzi, 1977). In a situation where prices have increased significantly between one year and the next, an advanced estimate based on the previous year's nominal income becomes much too low in relation to present income (Tanzi, 1977).Thus, we include this variable in the model.

Some studies point out the role of foreign aid in tax revenue mobilization. The idea is that, aid could exert a complementary or an eviction effect with domestic resource mobilization (Brun et al., 2011; Kaldor, 1962). Aid as an additional source of government revenue, provides an incentive for government to make less tax effort (substitution effect). Conversely, technical assistance that goes with aid helps countries improve their tax administration and mobilize revenue (complementary effect). Sometimes, costs associated with aid instability can also oblige them to rather preserve their tax effort in response to aid volatility (complementary effect).

We control for these variables since these additional variables (level of education, inflation and aid) could also explain the level of trade tax revenue. Results are given in table 2.10.

We do not find results suggesting improvements in our estimated coefficients, or any compensation effect that appears due to omission of such variables. Rather, the insignificance of our variables, still confirm robust results suggesting that incomes and property taxes are poor revenue compensation tools to balance for international trade tax revenue losses in developing countries.

Table 2.10: Adding more control variables

VARIABLES	(1) GMM-IV PIT	(2) GMM-IV CIT	(3) GMM-IV PT
L.PIT	0.821***		
	(0.0838)		
Trade tax	0.0139	-0.00194	-0.00206
	(0.0172)	(0.0267)	(0.00561)
Log(gdp capita)	0.0604	-0.135	0.0820***
	(0.0755)	(0.140)	(0.0285)
Agriculture	0.000733	-0.00612	0.000833
	(0.00504)	(0.00792)	(0.00153)
Trade	0.00142	0.00950***	-0.00127**
	(0.00118)	(0.00288)	(0.000550)
Natural resources	-0.00589**	0.000670	-0.00151
	(0.00291)	(0.00790)	(0.00163)
Inflation	-0.0308	-0.227*	0.0385
	(0.0476)	(0.120)	(0.0333)
School completion rate	0.000787	0.00204	0.00134*
	(0.00170)	(0.00389)	(0.000712)
Aid	0.00612	-0.0112	0.00403**
	(0.00399)	(0.00738)	(0.00173)
Corruption	-0.0438	0.00494	0.0131
	(0.0332)	(0.0550)	(0.0133)
Bureaucracy quality	0.0585	0.142*	-0.0145
	(0.0430)	(0.0847)	(0.0167)
L.CIT		0.412***	
		(0.155)	
L.PT			0.477***
			(0.0893)
Constant	-0.170	2.307*	-0.713**
	(0.696)	(1.192)	(0.294)
Observations	1,097	940	1,145
Number of country_code	84	75	80
Ar2	-0.0116	0.777	-0.541
Ar2p	0.991	0.437	0.588
Hansen	7.618	10.33	7.295
Hansenp	0.367	0.171	0.399
Ar1	-3.436	-1.731	-2.819
Ar1p	0.000591	0.0818	0.00482

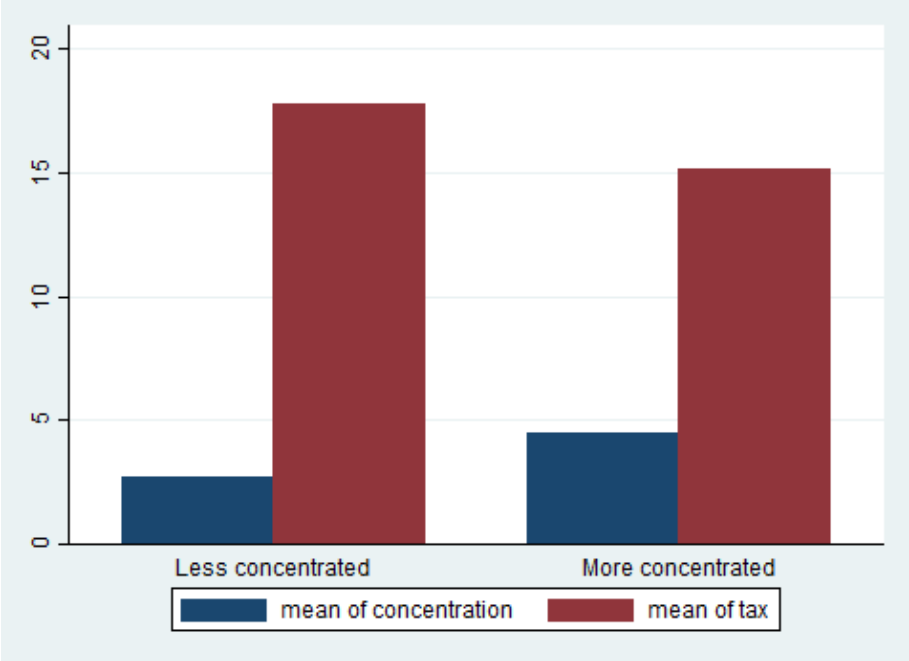
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

2.8.5 Economic diversification

The literature identifies the negative effect of commodities price shocks on tax revenue in less diversified economies (Diarra, 2012; Barrot et al., 2018; Gunning & Collier, 1996). A higher degree of diversification would contribute to reduce corporate exposure to external shocks and mitigate the effects of these shocks on government revenue. Economic diversification would contribute to reduce for example terms of trade instability, and this beneficial effect could lead to higher tax revenues. This can occur through expansion in major tax bases for example, wages or corporate profits (Gnangnon & Brun, 2017). Furthermore, economic diversification could reduce the dependence on international trade tax revenues, by expanding domestic production possibilities, thereby expanding opportunities for income generation and employment creation (McCalla & Valdes, 1997). We add this variable in the model and present results in table 2.11.

Our results suggest that corporate income tax can play a compensation role if and only if, economic activities are more diversified quick to extend corporate tax bases and reduce volatility of exporters firms to fluctuations in terms of trade. This result is provided in column 2 of table 2.11, where we also notice the direct beneficial effect of diversification on corporate tax revenue.

Graph 6: Diversification and revenue, year 2013.



Source : Author with IMF data. Theil index for export concentration.

Table 2.11: Economic diversification

	(1)	(2)	(3)
	GMM-IV	GMM-IV	GMM-IV
VARIABLES	PIT	CIT	PT
L.PIT	0.850***		
	(0.0858)		
Trade tax	-0.0599	0.243	0.0244
	(0.120)	(0.161)	(0.0353)
Log(gdp capita)	0.107	0.116*	0.0844***
	(0.0655)	(0.0691)	(0.0270)
Agriculture	0.00539	-0.000611	0.00195
	(0.00401)	(0.00528)	(0.00130)
Trade	-0.000190	0.00483**	-0.000192
	(0.00119)	(0.00189)	(0.000320)
Natural resources	0.00166	0.00331	-7.62e-05
	(0.00436)	(0.00672)	(0.00130)
Corruption	0.0264	-0.00425	0.0227*
	(0.0348)	(0.0383)	(0.0128)
Bureaucracy	0.0956*	0.106**	0.0160
	(0.0543)	(0.0536)	(0.0186)
Diversification	0.640	3.586**	0.373
	(1.276)	(1.721)	(0.367)
Trade tax*Diversification	0.278	-0.864*	-0.104
	(0.465)	(0.457)	(0.126)
L.CIT		0.519***	
		(0.154)	
L.PT			0.648***
			(0.0689)
Constant	-1.057	-1.463**	-0.752***
	(0.799)	(0.692)	(0.195)
Observations	1,467	1,257	1,560
Number of country_code	84	75	83
Ar2	-0.835	1.087	1.156
Ar2p	0.404	0.277	0.248
Hansen	60.08	57.82	63.31
Hansenp	0.330	0.408	0.234
Ar1	-2.704	-1.793	-4.018
Ar1p	0.00684	0.0864	5.87e-05

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

2.9 Conclusion

This paper investigates the balancing role of direct taxes (PIT , CIT and PT) over international trade tax revenue losses in developing countries consistent with "a second-generation tax transition concerns" in these countries. We do not find any direct compensation effect of direct taxes in the transition concerns over developing countries. However, we find that financial development plays an important role that helps raise revenue and balance international trade tax revenue losses with direct taxes. The effect is essentially driven by corporate income taxes. Moving towards a second-generation tax transition features in developing countries need the prominent role of financial development to modulate direct taxes revenue collection. Financial tools that aim to broaden financial sector depth, access, and inclusion (checks, cards, automated teller machine, mobile bank on phones) would certainly help provide information to the government in order to mitigate information challenges they encounter with direct taxes. This is ultimately a step to reach before thinking to any reform that can concern these taxes.

However, government must also be wise to enhance the stability of the financial sector that could help avoid its disturbances.

Even though we do not find any mediating effect with the internet variable, we suspect that the effect could exist, and the non-effect found in this paper is mainly due to the fact that technology is not limited to the internet. Government must take a step forward to broaden revenue collection patterns with digital tools in tax administration in line with the modern agenda for development.

Finally, the need is also to diversify economic activities in order to mitigate shocks on corporate profits and raise more revenue.

Appendix 1 : List of countries

Albania Ghana Niger El Salvador Argentina Guinea Nigeria Guyana Armenia Guatemala Nepal Colombia Azerbaijan Honduras Pakistan Ecuador Burundi Haiti Panama Nicaragua Benin Iran. Rep. Peru Algeria Burkina Faso Jamaica Philippines Botswana Bangladesh Jordan Rwanda Gabon Belarus Kenya Senegal Dominica Belize Cambodia Sierra Leone Trinidad and Tobago Bolivia Lao PDR Chad Indonesia Bhutan Liberia Togo India RCA Sri Lanka Thailand Chile Lesotho Tunisia Singapore Cote d'Ivoire Morocco Turkey Mongolia Cameroon Madagascar Tanzania Tonga Congo. Rep. Macedonia Uganda Comoros Costa-Rica Mali Uruguay Cape Verde Cyprus Mozambique Venezuela Djibouti Dominican R. Mauritania Vietnam Guinea-Bissau Egypt. Rep. Mauritius South Africa Grenada Ethiopia Malawi Zimbabwe Fiji Malaysia Mexico Kazakhstan Georgia Namibia Paraguay Suriname.

Appendix 2 : Descriptive statistics

	Obs	Mean	Std.dev	Min	Max	e(p25)	e(p50)	e(p75)
trade_tax	2784	2.810908	2.546233	0	14.98103	1.086852	2.076158	3.637904
tax_indiv	1791	2.469772	2.873793	0	21.1733	.7452002	1.478643	3.156467
tax_corp	1552	2.160708	1.546039	0	16.68605	1.112066	1.815966	2.85793
property_tax	1875	.3536357	.5653106	0	2.874321	.0033009	.0957197	.4514063
gdp_capita	2784	4897.02	8156.694	115.4357	53798.36	753.1547	2170.106	4953.01
agriculture	2784	20.01762	14.94732	.0354089	93.97742	8.453481	15.65995	30.05266
trade	2784	74.96737	45.64449	11.31517	441.6038	46.79324	65.13214	91.39772
natural_resources	2784	7.644417	9.953357	0	82.58936	1.019002	4.037945	10.24256
FD	2784	.2093697	.1611215	0	.948395	.1076089	.159624	.2591753
Internet	1978	10.75659	17.4762	0	88.21943	.1581499	2.314029	12.9414
inflation	2577	59.19403	794.9237	-35.8366	24411.03	2.810177	6.397883	12.05086
corruption	2784	2.606486	1.042665	0	6	2	2.5	3
school_completion	2107	54.77294	29.94631	.96368	100	27.35156	57.46252	81.81044
Aid	2488	.7.192796	9.550847	.675395	94.94603	.7287161	4.010163	10.35916
Bureaucracy	2784	1.665469	1.032052	0	4	1	2	2
Diversification	2466	.2975242	.0862854	.1626593	.5685362	.2282135	.2843333	.3464205

Appendix 3 : Scatter plots.

Fig 1: World map of financial development 2013

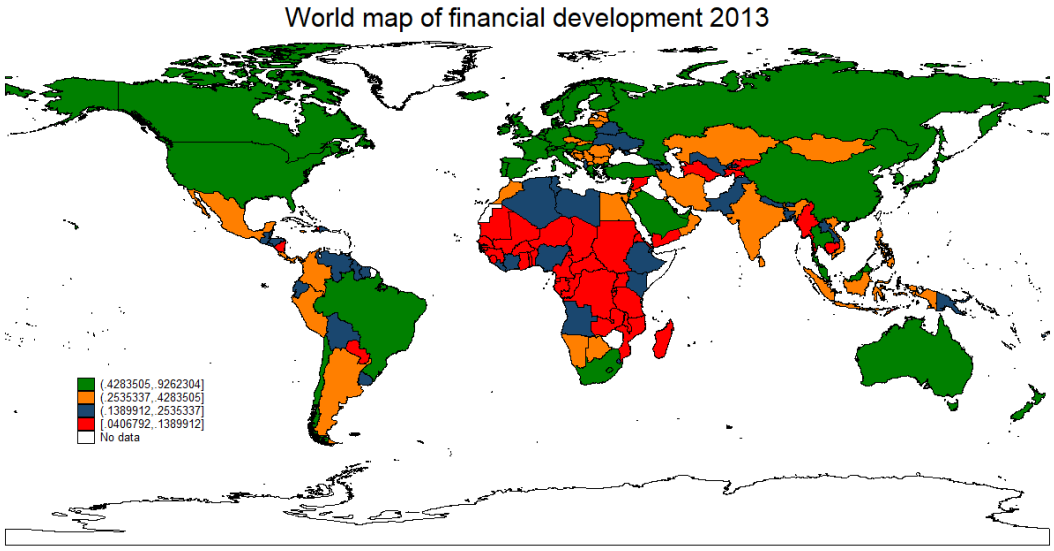


Fig 2: Tax revenue 2013

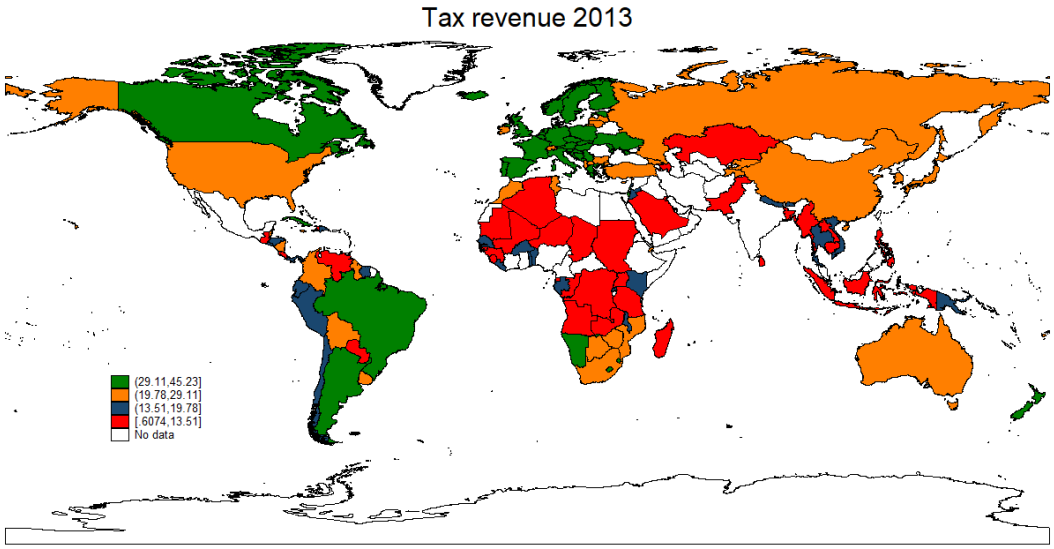
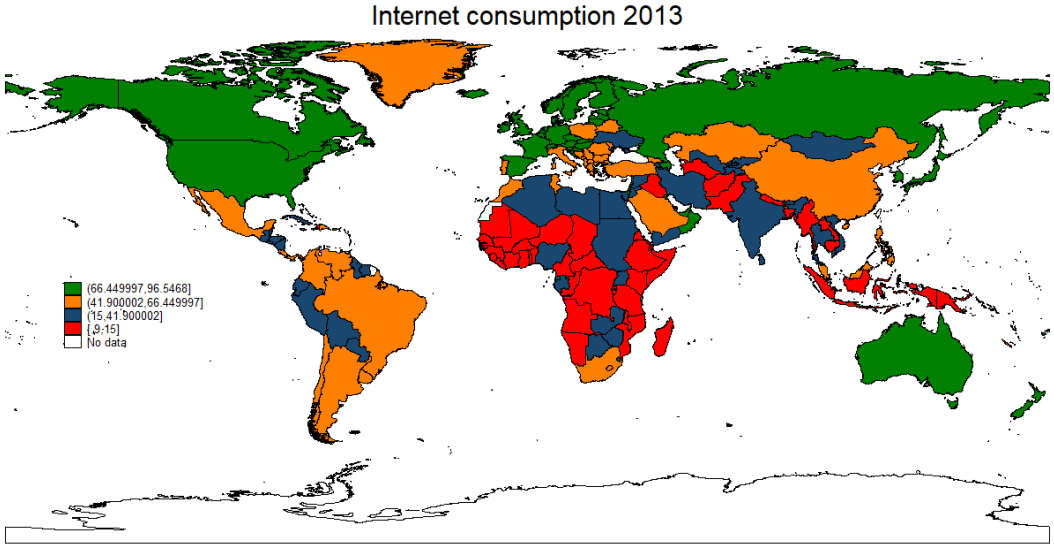
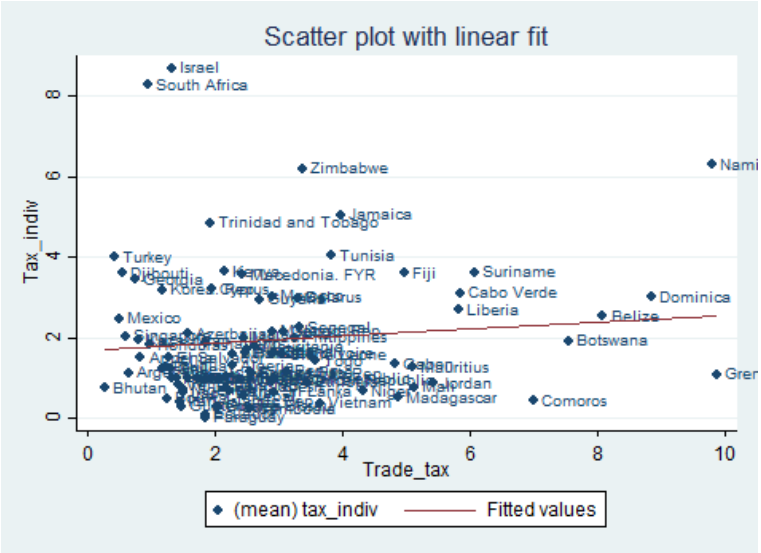
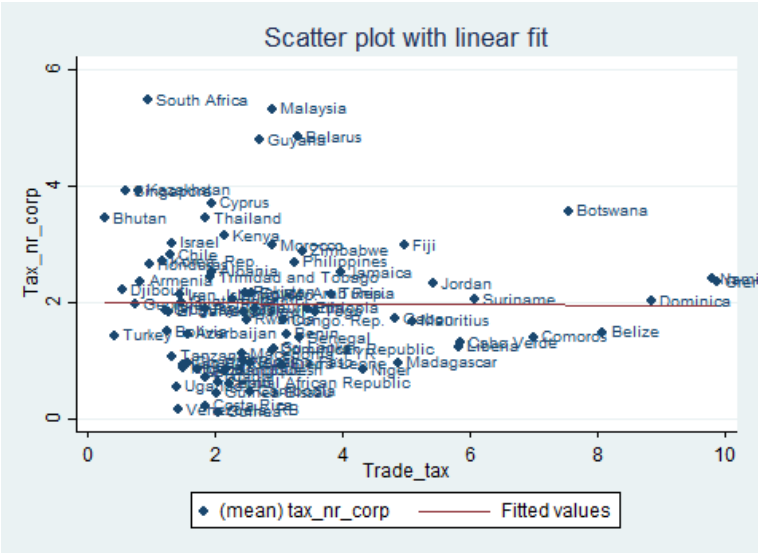
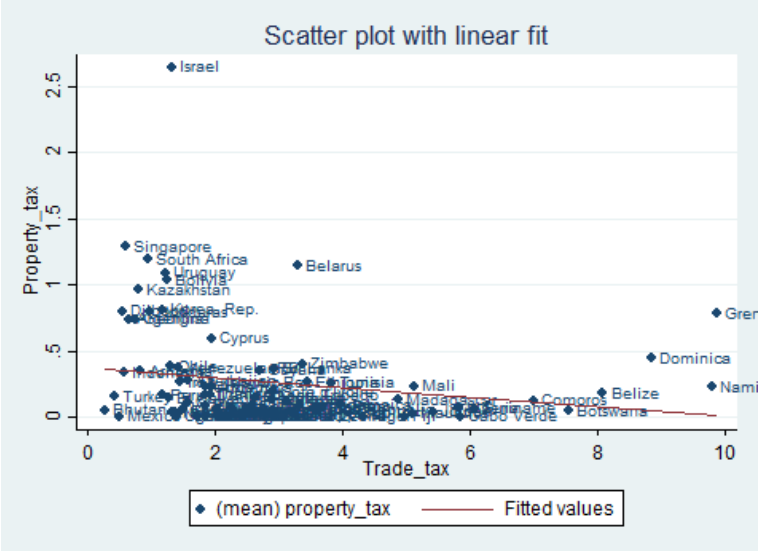


Fig 3 Internet consumption 2013




Scatter plot with linear fit
Tax_indiv
Trade_tax
Israel
South Africa
Zimbabwe
Jamaica
Trinidad and Tobago
Tunisia
Turkey
Fiji
Suriname
Cabo Verde
Liberia
Dominica
Belize
Botswana
Mexico
Comoros
Madagascar
Vietnam
(mean) tax_indiv
Fitted values


Scatter plot with linear fit
Tax_nr_corp
Trade_tax
South Africa
Malaysia
Belarus
Cyprus
Bhutan
Thailand
Botswana
Kenya
Israel
Fiji
Zimbabwe
Philippines
Jamaica
Jordan
Suriname
Dominica
Belize
Comoros
Madagascar
(mean) tax_nr_corp
Fitted values


Scatter plot with linear fit
Property_tax
Trade_tax
Israel
Singapore
South Africa
Belarus
Kazakhstan
Cyprus
Dominica
Zimbabwe
Tunisia
Mali
Belize
Comoros
Botswana
(mean) property_tax
Fitted values

Part II

THE CONSEQUENCES OF TAX TRANSITION IN DEVELOPING COUNTRIES.

Chapter 3

The efficiency consequences of the announcement of a tax transition reform : The case of WAEMU.

Abstract

Does the revenue replacement strategy of border taxes with domestic revenue collection increase efficiency in collecting revenues in developing countries? This paper attempted to answer the question, by assessing the efficiency consequences of announcing a tax transition reform program in West African Economic and Monetary Union Countries (WAEMU). Through impact evaluation framework with propensity score and synthetic control, we find that, the announcement of this reform increases efficiency in mobilizing resources at WAEMU level as compared to their counterfactual. Efficient mobilization of resources increases by near 4% around the reform agenda, and is achieved 3 years following the announcement of the reform. We also find that the reform improves tax oriented doing business indicators at the community level, by increasing the contribution rate score of firms by 22 scales and reducing collection time scores by 4 scales as compared to the best doing business practices on these indicators. The paper also evidenced that the reform is overall working through tax discipline rather than tax morale in these countries. Furthermore, having implemented semi-autonomous revenue agency (SARA) and adopted value-added tax (VAT) prior to the reform, fosters the revenue efficiency increasing effect of the reform, while the effect of adopting large taxpayers' units (LTU) is found to be inconclusive.

Keywords: Tax transition, efficiency, Propensity scores, Synthetic control, WAEMU countries.

3.1 Introduction

One of the major quests to which tax administration in developing countries strives is to collect revenue in an efficient manner, meaning collecting tax revenue in the fastest way possible without sizeable administrative or collection costs. This is becoming a leading preoccupation for many countries including developing ones, which are recently putting efforts towards modernizing their tax administration (Bodin, 2012; Taufik, 2018; de Jantscher et al., 1992). In this vein, many developing countries, are placing well-trained staffs, qualified human resources, more effective organization, digital transformation of tax administration, e-tax procedures (internet-based or bare-code based) or integrated tax collection systems at the disposal of their tax authorities in order to raise revenue quantitatively and qualitatively (R. Bird et al., 2008 ; R. Bird, 2010; Bhuiyan, 2011). Some cases are found in Kenya and Uganda revenue authority agencies among others Kangave (2005), and in some Asia developing countries with e-tax prospects (Bhuiyan, 2011). A body of the literature then, emphasized the determinants of tax revenue collection efficiency Katharaki and Tsakas (2010); Arvate and Mattos (2008); Mosomi (2015); Shahroodi (2010), and some of them come in general to the role of tax reforms (Osoro, 1993; Muriithi & Moyi, 2003; Bekoe et al., 2016; Byiers, 2005; Fjeldstad & Rakner, 2003).

A well-known tax reform discussed in the literature and suggested by international financial institution (World Bank, International Monetary Fund IMF) to developing countries is also tax-tariff reform. In its weak hypothesis, the reform consists in replacing border taxes following international trade liberalization, with domestic tax revenues collection in order to maintain and improve the level of public resources (Baunsgaard & Keen, 2010). The reform overall means, a change in the tax structure of developing countries with the main idea of removing inefficiencies[1] related to tariffs and recouping potential revenue losses with domestic taxation (Michael et al., 1993; Keen & Ligthart, 2002a). Policy prescriptions of the Washington-based financial institutions (IMF and the World Bank) are then based on the presumed efficiency gain of this integrated tax-tariff reform, since most of the revenue replacement strategies rely on consumption taxes such as value-added taxes (VAT), that are revenue mobilization tools in favour of economic efficiency (Aizenman & Jinjarak, 2008; Agha & Haughton, 1996b; Adhikari et al., 2015; Auerbach & Hines Jr, 2002; Antić, 2014). However, Emran and Stiglitz (2005) have challenged the validity of this prescription by pointing out the efficiency loss induced by the presence of a hard-to-tax informal sector in developing countries. For these authors, the current consensus on indirect tax reforms in developing countries that favors a reduction in trade taxes with an

[1]Border taxes are doubly distortionary. They interfere and distort both production and consumption decisions, while a domestic tax such as a perfect VAT for example, would be neutral vis à vis of production and consumption decisions. It is also for example well recognized that a domestic tax such as VAT introduces a due protection to domestic production of import substitutes, as compared to imported goods.

increase in domestic taxes such as VAT, ignores the existence of an informal economy in these countries. Once the incomplete coverage in VAT due to an informal economy is acknowledged, the standard revenue-neutral selective reform of trade taxes with VAT reduces efficiency under plausible conditions[2]. Second, as evidenced by Aizenman and Jinjarak (2009) trade liberalization should shift developing countries tax bases from "easy to collect" taxes (tariffs), towards "hard to collect" taxes (value-added and income taxes) thus affecting collection efficiency. Third, the standard prescription on efficient revenue-neutral reform, is also discussed by Munk (2008) that further challenged the production efficiency theorem of Diamond and Mirrlees (1971)[3], considering the case of tax-tariff reforms with costs of tax administration. According to this author, government administrative costs in enforcing and taxing domestic transactions are larger than taxing foreign trade (Munk, 2008; Evans, 2003). As a result, standing tax-tariff reform (hereafter tax transition reform) as a way to increase efficiency in revenue collection while taking into account administrative costs relative to domestic taxation, is a critical inquest that deserves to be solved may be empirically (Munk, 2008; Evans, 2003).

In West African Economic and Monetary Union (WAEMU[4]) countries, the issue of efficient mobilization of tax resources is particularly relevant in light of the region's trade liberalization policies. Since 2006, these countries announced a tax transition reform agenda through community based decisions making, consultable in the agreements N.10/2006/CM/UEMOA and N° 35/2009/CM/UEMOA. They are fully engaged in the reform under a stronger allegation that goes beyond the simple manner of recouping trade tax revenue losses with domestic taxation. They posit the reform in a broader sense that consists in transforming progressively the tax system (equity, transparency, liability, tax morale, and reducing the social cost of public revenues) for maintaining an appropriate level of overall tax revenue (Chambas, 2005b). To succeed this reform, adopted in "de jure" and in "de facto" narratives as compared to other African countries, they also take steps towards coordinating and harmonizing tax rules in the region with the aim of enhancing revenue efficiency towards reducing collection costs, and increasing tax compliance and tax morale (Mansour & Rota-Graziosi, 2012; Diakite et al., 2017a).

After several years of announcement and implementation of this tax reform, it makes sense to analyze its effects on the efficiency of collecting resources in these countries. To the best of our

[2]According to authors, inefficiency of VAT due to the presence of a large informal sector is understandable in the way that, VAT would increase the inter-sectoral distortions between formal and informal sectors activities, thus leading to a dual tax economy in these countries.

[3]The Diamond and Mirrlees (1971) efficiency theorem implies that when lump-sum taxation is not available, it is optimal for a government in a small open economy to rely on taxes on the net demand of households rather than on border taxes to increase production efficiency.

[4]The WAEMU includes Benin, Burkina Faso, the Côte d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal and Togo. These eight countries share the African Financial Community Franc (CFA), which is managed by the Central Bank of West African States (BCEAO).

knowledge, this paper is the first attempt to empirically address the impact of the announcement and adoption of the suggested reform on efficient collection of resources in these countries.

The paper pursuits two main objectives: studying the effect of the announced tax reform (tax transition reform) on the efficiency of collecting revenue in WAEMU countries, and testing whether the reform adopted in a broader sense, also contributes to improve some tax- oriented doing business indicators in these countries. The study is based on impact evaluation framework, through propensity scores and synthetic control method, that would help answer the question "whether the announcement and adoption of this reform in WAEMU countries in a broader sense, led to efficiency in revenue collection as compare to other African countries, and if it has contributed to improve some tax-oriented doing business indicators in these countries as a consequence". Further, the study aims at testing for two main transmission channels through which the reform may impact collection efficiency : the channel of tax-compliance (tax discipline), and the channel of tax morale (tax citizenship). For this purpose, the paper made use of available Public Expenditure and Financial Accountability (PEFA) 2006 and 2011 scores framework, to address these issues, notably if the reform increases transparency in taxpayers' obligations and liabilities (the one we call here for simplicity "tax morale") and/or effectiveness in taxpayers' registration and audit procedures (the one we consider here as "tax compliance").

The paper is structured as follows : section 2 presents some elements of existing literature on tax-tariff reforms and production efficiency. In section 3, we aim at presenting the reform in WAEMU countries, while section 4 presents data and produces some stylized facts about the concerned reform in these countries. In section 5, we handle with the empirical framework, followed by results in section 6. Then the paper addresses some sensitivity analyses in section 7. The last part of the paper is concerned about the conclusion and some elements of policy recommendations.

3.2 Literature review

What we know about the efficiency consequences of tax-tariff reform in the literature is very mixed. In a general principle, it is well-known that it is optimal for a small open economy to raise any revenue it needs by setting all tariffs to zero and relying entirely on destination-based consumption taxes for example (Dixit, 1985). This result is also consistent with the Diamond and Mirrlees (1971) theorem on the desirability of production efficiency. According to Diamond and Mirrlees (1971), when lump-sum taxation is not available, it is optimal for a government in a small open economy to rely on taxes on the net demand of households rather than on border taxes to increase production efficiency. However, the results may break down when considering

(1) the presence of an informal economy, (2) imperfect competition between goods, and (3) the presence of administrative costs.

For the first point of view, while a radial reduction in tariff is shown to alleviate both consumption and production distortions in the economy, a revenue-neutral increase in VAT for example, reinforces inter-sectoral distortions between formal and informal sectors (Emran & Stiglitz, 2005). Informality is a costly narrowing tax base that creates serious distortions in economic and tax activities (Emran & Stiglitz, 2000; Stiglitz, 2010). According to authors, one of the reasons that a VAT is "efficient" for example, is that, it is comprehensive; yet in most developing countries, the VAT is far from comprehensive, and by itself means it interferes with productive efficiency, encouraging movement of production into the informal economy Stiglitz (2010). While there is extensive literature on the tax-tariff reform, the inefficiencies caused by an informal sector has been neglected in this literature, with also an exception in the contribution by Piggott and Whalley (2001). Authors evidenced supply-side substitution towards informal and formal production (self supply) due to the presence of an informal economy. Nonetheless, Ligthart and Meijden (2010) tend to reconcile the debate. They show that, the Washington-based policy line remains valid even when a substantial informal sector exists, once allowance is made for factor market dynamics. According to the authors, given that import-competing sectors are typically much more capital intensive than the rest of the economy (including the informal sector), the import tariff would be relatively more distorting compared to a consumption tax (Ligthart & Meijden, 2010). The reform would alleviate tariff distortions yielding to much production and little consumption of import substitutes, than it would exacerbate consumption tax distortions (also giving rise to excess home production). And yet, Keen and Lockwood (2006) also show that a large informal sector is not a sufficient condition for border taxes to be preferable to a VAT regime in the face of efficiency-improving tariff cuts. It rather preserves efficiency by taxing partly informal sectors' inputs from VAT-compliant firms, as well as imports by firms that are not registered for VAT (Keen & Lockwood, 2006).

Another strand of the literature questions the perfect versus imperfect market competitions in the reform strategy. Keen and Ligthart (2005) explore the implications of imperfect competition in realizing efficiency gains from trade liberalization for a strategy of combining tariff cuts with a point-for-point increase in destination-based consumption taxes. To establish the result that efficiency gains may be undesirable under imperfect competition, they posit a Cournot duopoly model, and consider two tax–tariff reform strategies both imitating the strategies they evidenced in earlier work Keen and Ligthart (2002a), to be unambiguously beneficial under perfect competition: (i) tariff cuts combined with a one-for-one increase in consumption taxes; and (ii) tariff cuts combined with increases in consumption taxes so as to keep the consumer price constant. Their model encompasses two tradable goods and two countries. In the background scenario,

there is a numeraire bearing no tax or tariff, traded competitively, and produced using a single factor under constant returns to scale. The home market for this good is served by two firms, one domestic and the other foreign, sharing the same downward-sloping demand curve for their homogeneous product. The two firms are identical, having constant marginal cost of production. The strategy for coordinated tax–tariff reforms that Keen and Ligthart (2002a) show to be unambiguously beneficial for a small competitive economy can be characterized in either of the two ways: as involving equal but opposite changes in consumption taxes and tariffs, or as leaving consumer prices unchanged in the face of a tariff cut. For a small, competitive economy, these two characterizations are precisely equivalent. For the imperfectly competitive economy, they are not. It is evident that setting an opposite change in consumption taxes and tariffs will change the consumer price, because it will change world output. They show that neither kind of reform is necessarily desirable in the presence of imperfect competition (Keen & Ligthart, 2005). And according to Haque and Mukherjee (2005), higher product differentiation in a market structure where each firm is monopolist for its products, would also escape conventional results established in previous literature in the tradition of (Keen & Ligthart, 2002a).

Finally, another side of the literature discussed previous findings with respect to administrative costs in collecting taxes. For example, Munk (2008) finds that, with reference to administrative costs, border taxes would be preferred to domestic taxes. Border taxes are associated with lower administrative costs, and this difference is sufficiently large to justify the larger distortionary costs associated with border taxes as compared to domestic taxes. Mihaljek (1992) also studied an optimal tax problem for a small open economy where collecting taxes are costly. The author shows that, in the presence of collection costs, the standard rules of optimal commodity taxation (the Ramsey inverse elasticity rule) may no longer be valid and tariffs may replace domestic taxes as a second-best revenue-raising device. The tax policy literature has noted that although tariffs are less efficient in allocating resources than are domestic taxes, they constitute a major revenue source for countries with poorly developed tax administration because they are relatively easy and inexpensive to collect and, therefore, administratively more efficient than retail sale taxes or value-added taxes. The optimal taxation literature has ignored the administrative costs of taxation. The considerable collection costs, which differ substantially from one commodity to another, and the fact that some taxes are easier to collect than others, may hide distortions induced by a tariff. If the difference between the marginal collection costs of the consumption tax and tariff is greater than the production distortion introduced by a tariff, then revenue will be raised more efficiently using a tariff (Mihaljek, 1992).

3.3 Overview of WAEMU's tax transition program

Like many developing countries characterized by large informal sectors, the efficient mobilization of fiscal resources is a major challenge for WAEMU member countries. This issue is particularly relevant with respect to government current expenditure and the public investment needs of WAEMU countries (infrastructure, education and health) that are necessary for their development. The particularity of WAEMU countries lies in the fact that they form an economic and monetary union with a common monetary policy and fiscal policies constrained by budget deficit rules of less than 3% of GDP in order to avoid the dominance of national fiscal policies over the common monetary policy. In addition, WAEMU countries are particularly involved in regional integration projects with the expectation of capturing the related gains in trade development. To this end, the WAEMU zone which adopted a single currency since the years of independence, has deepened the regional integration of its member countries since 1994 through progressive tariff dismantling. This process culminated in the establishment of a custom union in 2000 with a functional common external tariff (CET). They also participate in the ECOWAS Customs Union, which also has a Common External Tariff (CET) operational from 2015. Finally, WAEMU countries are also engaged in the African Continental Free Trade Area (AfCFTA) project. These various impulses towards trade integration significantly reduce custom revenues, hence the need to implement appropriate reforms aimed at improving the efficient collection of domestic taxes. Within this framework and following the recommendations of the Bretton Woods institutions, particular emphasis is placed on the collection of Value Added Tax (VAT) because of its economic neutrality.

To address these challenges, WAEMU countries have been harmonizing value-added tax (VAT) and excise duty regimes since 1998 in order to foster the emergence of competitive economic and financial activities in a competitive market and a streamlined fiscal and legal environment. In 2006 they then announced the tax transition reform program, i.e., the gradual transfer of tax pressure from border taxation towards domestic taxation. This tax transition reform program is accompanied by an institutional mechanism for monitoring its implementation through national committees responsible for monitoring its application in member states (WAEMU, 2009).

Conceptually, WAEMU's tax transition reform program is structured around four axes: support for growth and development financing, consolidation of the achievements of the common market, optimal mobilization of tax and custom resources, and capacity building and synergy between tax and custom administrations.

Following the first pillar, WAEMU's tax transition program should promote the development of internal savings to finance the investments required to achieve strong pro-poor growth. Effective protection of certain sensitive agricultural and industrial sectors is planned in order to meet the

new financing needs of community programs.

Consolidation of the achievements of the common market is based on a more rigorous application of trade liberalization measures and the common external tariff, and on further harmonization of direct and indirect taxation. Indeed, the tax transition program in WAEMU countries should facilitate the deepening of the common market by strengthening instruments for liberalizing intra-community trade and removing all residual obstacles to the free movement of goods. At the domestic level, the aim is to establish a common-law tax system that is better linked to custom taxation. This tax system should facilitate the mobilization of tax revenues and the proper allocation of resources and should be oriented towards the promotion of competitiveness and economic growth. In this regard, the harmonization of direct and indirect taxation will play a pivotal role in the mobilization of tax and custom resources with a view to providing the State with sufficient resources while minimizing economic distortions. The tax transition program would encourage the elimination of exemptions, tax relief and other tax incentives that distort competition. The expansion of the tax base and the taxation of informal activities are also levers of the program to improve tax policy indicators. In addition, the pillars of the Union's tax transition program are the improvement of the tax environment through the fight against fraud and corruption, the promotion of good fiscal citizenship, the simplification of procedures, the establishment of a tax system adapted to small businesses, and the search by governments for a relationship of trust between the administration and the taxpayers.

The third line of the WAEMU's tax transition program focuses on the effective and efficient mobilization of resources through the modernization of tax administrations. This modernization concerns rules, procedures, institutional and organizational aspects, as well as the use of new information and communication technologies. Within this framework, the program is supported by the improvement of the tax collection and control system, particularly in accordance with the principles of risk management, and the modernization of the organization and working methods of the tax and custom administrations in order to make the collection of taxes, duties and fees more efficient. The digitalization of customs and tax procedures as well as the optimization of custom procedures and formalities are also essential.

Finally, WAEMU's tax transition program could not be successful without upgrading tax administration officials. To this end, strengthening the human resource capacity of tax and custom administrations is the final component of the program. The objective is to minimize tax evasion. Within this framework, an optimal allocation of budgetary resources is necessary for these administrations in order to ensure the collection of tax resources at the lowest possible cost.

3.4 Data and stylized facts

This study covers a sample of thirty two (32) Sub-Saharan African countries including the eight (8) WAEMU countries over the period from 2000 to 2016 due to data availability. The countries included in the sample are detailed in the appendix. The study exploits several databases and several indicators.

Our variable of interest which represents the tax reform variable, is a dummy variable that takes the value 1, since the announcement of the reform in WAEMU countries in 2006, and 0 before this date.

The revenue efficiency variable is estimated using the stochastic frontier method. Indeed all production processes represent a transformation of inputs, for example, labor, capital, and raw material, into outputs which can be either in physical units or services (Kumbhakar et al., 2014). We therefore apply this technique to tax collection by considering a set of variables as input used for tax collection (output). The difference between the stochastic production and the other used in empirical research concerns the error term which in the former is divided in two or more parts. From an econometric point of view, the estimation of frontiers is interesting because the concept of maximality puts a bound on the dependent variable. In this paper, we use the approach proposed by Kumbhakar et al. (2014) which allows the efficiency term to vary over time. The estimation of efficiency scores using this approach is presented in more detail in the appendix.

Macroeconomic variables such as tax variables, particularly trade and domestic taxes are taken from the International Centre for Tax and Development (ICTD, 2019) database. Other used macroeconomic variables such as the percentage share of value-added of the agricultural sector to GDP, the total natural resource rent as a percentage of GDP, the size of a country's total population, and the percentage of population covered by internet are taken from World Bank Development Indicators (WDI, 2019). A macroeconomic variable such as the human development index comes for its part from the United Nation Development Program (UNDP) database. Variables used in this study are the ones practically found in the studies of Keen and Lockwood (2010) concerning tax reforms.

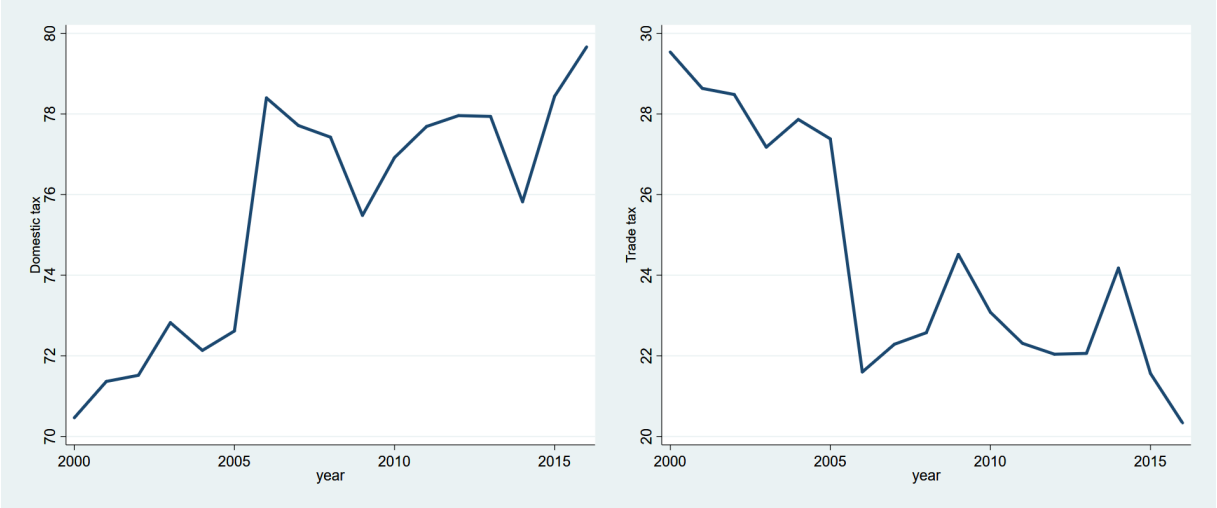
The study also exploits institutional and socioeconomic variables as control variables, namely the scores of corruption, democratic accountability and socioeconomic conditions (poverty, unemployment, consumer confidence in a single index). They are drawn from the International Country Risk Guide (ICRG) database.

Finally the study also makes use of the variable of financial development as an additional control variable. We take advantage of a new composite financial development index introduced by the IMF Strategy Policy and Review Department constructed from various indicators of financial

systems to capture financial development.The index accounts for financial development in a multidimensional way, involving banking and non-banking institutions, as well as stock markets development (Svirydzenka, 2016).

Graph 1 below shows the evolution of the WAEMU zone average share of domestic taxes and trade taxes in overall tax collected over our period of study. It highlights opposite trends in the two indicators extending the period 2000 to 2016. In fact, while the share of domestic taxes in total taxes shows an upward trend, rising from 70% in 2000 to 79% in 2016, the share of trade taxes declines each year. It has decreased from 29% in 2000 to 19% in 2016, a drop of 10 percentage points. These trends highlight the tax transition in progress in WAEMU countries. Indeed, the significant decline in trade taxes reflects the combined effects of the various trade integration impulses that began with the tariff dismantling policies initiated since 1994 and culminated in the implementation of a common external tariff in 2000. Meanwhile, efforts to harmonize direct and indirect taxation in the countries, coupled with the modernization of the fiscal environment, the simplification of procedures, the fight against corruption and the promotion of fiscal citizenship, have had a positive impact on domestic tax collection, which has continued to grow over the study period. Indeed, a closer analysis of Graph 1 allows us to distinguish two phases in the dynamics of the share of domestic taxes, a first phase from 2000 to 2005 and a second phase from 2006 to 2016. This second phase is characterized by a higher rate of growth in domestic taxes and matches the period of implementation of the zone's tax transition program.

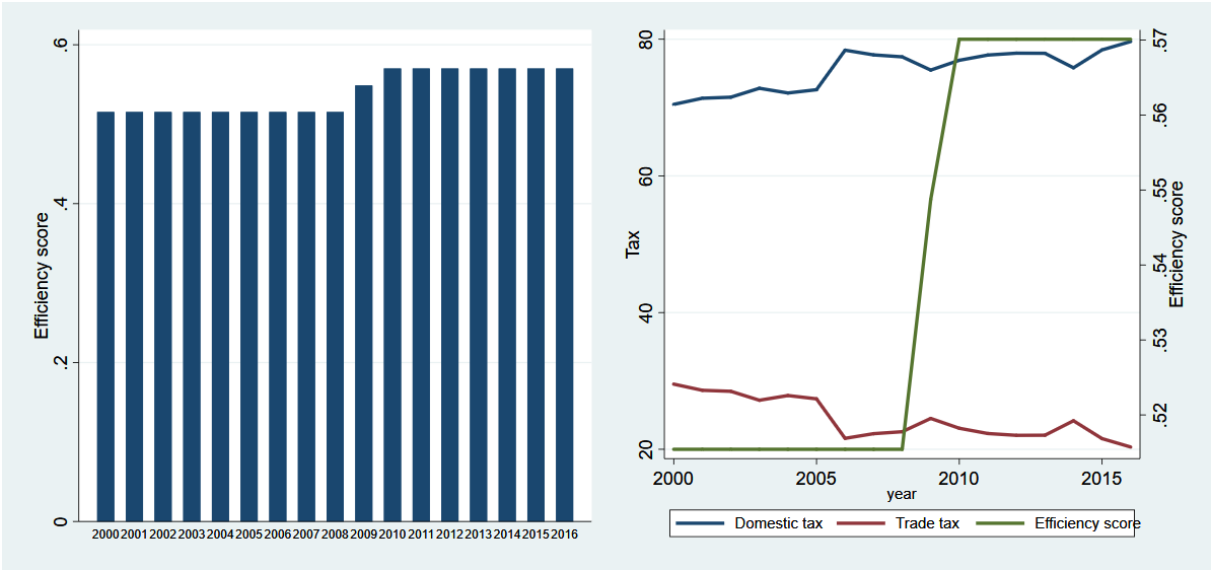
Graph 1: Tax transition in WAEMU countries from 2000 to 2016



The effects of the tax reform introduced by WAEMU countries are not limited to the substitution of trade taxes by domestic taxes. Graph 2 below shows the variation in the average tax collection efficiency score of WAEMU countries. Graph 2A suggests a structural break in the dynamics of the efficiency score as of 2009, three years after the implementation of the reform.

This break is reflected in an improvement in the efficiency score as of 2009. The delay observed between the adoption of the reform and its effects on efficiency could be explained by the time required to translate the community measures into national legislation and their effective implementation. Moreover, although the reform was announced in 2006, the institutional framework for monitoring the program was only set up in 2009 with the establishment of national program monitoring committees in each member country.

Graph 2: Tax revenue efficiency and tax transition in WAEMU countries from 2000 to 2016



Finally, to corroborate these ideas, we illustrate in graph 2B the evolution of these three variables, notably domestic taxes, trade taxes and the efficiency score of tax collection. It shows a fairly interesting coincidence of the period of announcement of the tax transition program with that of the improvement of tax collection efficiency and the progressive substitution of trade taxes by domestic taxes. This analysis could suggest a positive effect of the reform on the efficiency score of tax collection. However, it allows only a global overview of the evolution of the variables of interest. It does not take into account other factors that may influence these variables. We extend this descriptive analysis with a more rigorous econometric analysis using impact evaluation tools.

3.5 Empirical framework

This section introduces the methodological approach used in this paper, namely the propensity score matching, followed later by the synthetic control method.

3.5.1 The propensity score matching (PSM) framework

As previously highlighted, this paper will provide an empirical assessment of the effect of announcement of the tax transition program in WAEMU countries, on revenue collection efficiency. To reach our goal, we use an impact evaluation framework based on propensity score methods (PSM). This method is widely used in the literature to identify the effect of a program intervention on relevant targeted outcomes. The starting point of the evaluation process is mostly based on the evaluation framework suggested by (Rubin, 1974). Basically, measuring the effects of the implementation of a program on a concerned outcome is equivalent to comparing the outcome of the treated units with their situations if they had not been treated. But the outcome of the treated units without the reform is most often unobserved, and cannot be approached by the outcome of untreated units (Rubin, 1974). The idea behind the propensity score framework is to estimate a counterfactual situation of the treated units based on matching techniques on the probability treated and untreated units have to be treated. Following Rosenbaum and Rubin (1983a) the propensity score is the conditional probability of assignment to a particular treatment given a vector of observed covariates X. It is designed to remove selection bias in the entry to treatment by treated units based on a certain number of explanatory factors, thus leading to better quantify the causal effect of the intervention. Both large and small sample theory show that adjustment for a single score (propensity score) is sufficient to remove the bias due to all observed covariates (Rosenbaum & Rubin, 1983a). Truly, propensity scores, are used to match reform countries to non-reform countries, thereby constructing a convincing statistical control group, that represents the counterfactual situation of reform countries. Let $Y1$ be the outcome of treated units, and $Y0$ the outcome of "comparable" untreated units, and T a dummy variable taking the value 1, for treated participants and 0 for untreated units. The relevant evaluation parameter of interest is the mean effect of treatment on the treated group with characteristics X, known as the "average treatment effect on the treated ATT". It follows:

$$ATT = E(Y1 - Y0|T = 1, X) = E(Y1|T = 1, X) - E(Y0|T = 1, X) \tag{3.1}$$

In this situation, $Y1|T = 1$ is the observed outcome of the treated units, and $Y0|T = 1$ the outcome of the treated country if it had not implemented the reform. $Y0|T = 1$ is estimated through the counterfactual situation based on the matching procedure as it is an unobserved outcome (Rosenbaum & Rubin, 1983a). The method mentioned here then allows the treated and control groups to be matched on their probability of being treated, thus indirectly be matched on observable characteristics (Rosenbaum & Rubin, 1983a). With the PSM method, the difference between countries is only due to being treated or adopting the reform. In other words, this method ensures that the individuals in the treatment and control group are identical in all except on the treatment variable. The matching based on the likelihood of adopting the reform

ensures similarity of initial conditions and country characteristics in the control group.

The PSM method involves a two-step approach. First, the probability of observing entry into treatment is estimated conditional on observable economic conditions and country characteristics. We model the likelihood of adopting tax transition reform as a function of observed macroeconomic variables, namely the past level of trade tax revenue, resource rents, value-added of the agriculture sector, as well as socioeconomic (poverty, unemployment, consumer confidence) and demographic conditions (size of countries' total population) that could constrain a government to act for a reform (Keen & Lockwood, 2010). We also add institutional variables such as the level of corruption and prevalence of democracy, as well as the presence of qualified human resources captured by the level of Human Development Index(HDI). Finally we also conjecture that the level of financial development and countries' digital transformations may also constitute a signal to tax authorities and to countries to adopt the reform, as they may facilitate the collection of taxes in the reform agenda. These variables also influence revenue collection efficiency as recommended in the matching literature. We use sets of variables related to the program participation as in the studies of (Dehejia & Wahba, 2002).These authors have mentioned that in order for matching estimators to have low bias, it is necessary to have a rich set of variables related to program participation (Dehejia & Wahba, 2002; J. A. Smith & Todd, 2005).

Second, these probabilities, or propensity scores, are used to match reform countries to non-reform countries, and thereby construct a statistical control group.

3.5.2 Matching quality and inference

As highlighted by Rosenbaum and Rubin (1983b), in a randomized experiment, the results in the treatment and control groups may be directly comparable because units are likely to be similar and have the same probability of being treated, whereas in a non-randomized experiments, such direct comparisons may be misleading because units exposed to the treatment generally differ from ones unexposed. Balancing scores can then be used to group treated and control units so that direct comparisons are more meaningful. Propensity scores must be good balancing scores, meaning must be able to cover a large part of the differences in observables between treated and untreated units. This means that propensity score which is a function of observed covariates X, must sizeably overlap the conditional distribution of X between the treated ($T = 1$) and control units ($T = 0$) and creates a large common support region

$$T \perp X|p(X) \tag{3.2}$$

In order to ensure that the two groups are comparable, or to check the overlap and the region of common support we rely on the minima/maxima comparison proposed by Caliendo and Kopeinig (2008). The basic idea of this approach is to delete all observations whose propensity scores are smaller than the minimum and larger than the maximum for causal inference (Caliendo & Kopeinig, 2008). One suggested approach is also a visual analysis of the density distribution of the propensity score in both treated and control groups after matching (Lechner, 2001). Yet, to test the balancing property of the propensity score, we rely on the t-test approach of Rosenbaum and Rubin (1985b); and the pseudo-R2 approach of Sianesi (2004).

Finally, while in a randomized experiment, treatment assignment T and response R are known to be conditionally independent given X (strongly ignorable treatment assignment), this condition is usually not known to hold in a non-randomized experiment.

$$T \perp R|X \tag{3.3}$$

The central idea behind the matching method is to use the control group to imitate a random experiment. Thus, the conditional independence assumption must be satisfied for inference. We test for the conditional independence assumption, by using different matching methods: nearest neighbor matching H. L. Smith (1997), caliper and radius matching Cochran and Rubin (1973), kernel and local linear regression matching Heckman et al. (1997); Heckman et al. (1998), nearest neighbor corrected bias matching (Abadie et al., 2004). We also perform Rosenbaum bounds sensitivity tests (Rosenbaum, 2002; Gangl, 2004).
Standard errors and statistical significance of the treatment effect are obtained based on bootstrapping methods (Lechner, 2002).

3.6 Results

3.6.1 The estimation of the propensity scores

Table 3.1 reports results of the first step of the PSM methodology. We report probit estimations of the likelihood of adopting tax transition reform program controlling for major determinants (macroeconomic, institutional, socio-demographic etc...) that could motivate a country to adopt this reform. This extends Keen and Lockwood (2010) analytical framework on the determinants of tax reforms in developing countries.
We mostly find that the past level of trade tax revenues is a warning signal for a country to enter tax transition reform program. Indeed, the negative sign next to the marginal effect of this variable suggests that a country that has no past constraints on its trade tax revenues (the

case where trade tax revenues continue to account more in its total tax revenue) has no incentive to enter a tax transition reform program. This interpretation conversely suggests that, the anticipation to implement a tax transition reform program increases when the level of past trade tax revenue decreases. This result is provided in column 10 of table 3.1, where the likelihood of implementing the reform increases by 0.2% when a country's trade tax to total tax ratio decreases by one percentage point. This effect is statistically significant at 5% level.

In addition, we found that, as the agricultural sector becomes more important in terms of GDP, this leads a country to adopt domestic tax reforms and find ways to tax the "hard-to-tax" activities, and to recoup revenue losses from trade taxes. This result is also provided in column 10 of table 3.1, where we find a statistically significant marginal effect of 0.6% at 1% significance level.

However, unlike previous studies of Keen and Lockwood (2010) and C. Ebeke et al. (2016) that found positive effect of population size on VAT adoption as a tax reform for example, we rather find a negative effect of this variable on tax transition reform suggesting that, the larger the size of a country's total population, the lower the probability that it will adopt this reform, because of potential bargaining powers between winners and losers of the reform in the population. A large population is also most often seen as a population with more resurgence of conflicts of interest. Our results may probably support a "political economy" hypothesis of the reform in more populated areas of countries.

Corruption has the expected sign on the likelihood of implementing the reform, since most corrupted individuals and citizens tend to slow down regulatory processes that may conduct to the implementation of a successful tax reform including successful tax transition reform program in least developed countries.

Further, we hypothesize regarding the marginal effect of the variable of democracy, a non linear effect of democracy on tax reform. Indeed, the prevalence of democracy and civil liberties may exhibit a turning point in its relationship with tax reform. It may be the case, for example, in least developed countries that, adopting and implementing a successful tax reform, requires a minimum level of democratization in order to pass adopted tax laws into regulatory texts. But we are aware at this stage to introduce non-linearities in a non-linear probit model as this would make our estimates non-convergent (Ai & Norton, 2003).

Finally, we found that, financial development encourages the adoption of tax transition reform program, in the sense that, countries with a robust financial sector will tend to put this sector at the service of tax reforms, that may help facilitate the collection of taxes in the reform agenda. This result is also provided in column 10 of table 3.1 where we find a statistically significant effect of financial development at 1% significance level.

Table 3.1: Probit estimates: marginal effects

VARIABLES	(1) tax_reform	(2) tax_reform	(3) tax_reform	(4) tax_reform	(5) tax_reform	(6) tax_reform	(7) tax_reform	(8) tax_reform	(9) tax_reform	(10) tax_reform
Trade tax lagged	-0.00159	-0.00230**	-0.00245**	-0.00242**	-0.00242**	-0.00206*	-0.00204*	-0.00146	-0.00184*	-0.00210**
	(0.00106)	(0.00111)	(0.00112)	(0.00114)	(0.00120)	(0.00120)	(0.00122)	(0.00101)	(0.00108)	(0.00104)
Agriculture		0.00424***	0.00474***	0.00457***	0.00457***	0.00431***	0.00506***	0.00731***	0.00735***	0.00611***
		(0.00120)	(0.00120)	(0.00123)	(0.00122)	(0.00117)	(0.00117)	(0.00117)	(0.00123)	(0.00142)
Natural resources			-0.00260*	-0.00276*	-0.00276*	-0.00304**	-0.00311**	-0.000990	-0.00115	-0.000916
			(0.00144)	(0.00145)	(0.00145)	(0.00148)	(0.00142)	(0.00122)	(0.00129)	(0.00126)
Socioeconomic conditions				-0.0135	-0.0135	0.0112	0.0181	0.0121	0.00990	0.00570
				(0.0155)	(0.0163)	(0.0177)	(0.0166)	(0.0142)	(0.0154)	(0.0146)
Log(population size)					0.000199	-0.00578	-0.00549	-0.0171	-0.0233*	-0.0277**
					(0.0132)	(0.0129)	(0.0133)	(0.0124)	(0.0136)	(0.0127)
Corruption						-0.0851***	-0.0711***	-0.0628***	-0.0707***	-0.0671***
						(0.0215)	(0.0217)	(0.0190)	(0.0210)	(0.0206)
Democratic accountability							-0.0479***	-0.0437***	-0.0456***	-0.0425***
							(0.0140)	(0.0113)	(0.0124)	(0.0121)
Financial development								2.338***	2.889***	2.903***
								(0.342)	(0.443)	(0.432)
Internet ratio									-0.00391*	-0.00254
									(0.00222)	(0.00236)
Human development index										-0.378
										(0.237)
Constant	-0.839***	-1.261***	-1.177***	-0.985***	-0.999	-0.237	0.155	-0.582	-0.110	1.309
	(0.116)	(0.174)	(0.191)	(0.256)	(0.928)	(0.946)	(1.011)	(1.155)	(1.200)	(1.191)
Observations	544	544	544	544	544	544	544	544	544	544
Pseudo R2	0.00344	0.0229	0.0268	0.0280	0.0280	0.0465	0.0661	0.150	0.157	0.160

Robust standard errors in parentheses

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

3.6.2 The results of matching on propensity scores

Table 3.2 provides results of the matching procedure, namely the average treatment effect on the treated (ATT). Using the estimated propensity score, we match WAEMU countries with their counterfactual that did not necessarily announce the reform. We first draw upon four classical matching methods namely, nearest-neighbor matching, radius matching, local linear regression matching and kernel matching and finally the nearest neighbor corrected bias estimator of (Abadie et al., 2004). The nearest-neighbor matching, matches treated with controls that have the closest propensity score (we perform up to 3 neighbors). In radius matching each treated country is matched with control units within a radius of propensity score (we retain a small R = 0.005, a medium R = 0.01, and a large R = 0.05 radius). In the local linear regression matching, covariates-adjusted outcomes of each treated country are matched with the corresponding non treated country. Finally in kernel matching, counterfactual is constructed with a weighted-average of control units (weights are inversely proportional to the gap between

the propensity score of the treated and the non treated countries) to match the treated.
For these classical matching methods, we report in regression tables, statistical tests that support the quality of the matching procedure namely (1) the balancing property of the propensity score, that help assess the bias due to incomplete matching Rosenbaum and Rubin (1985a); and (2) the hidden bias due to unobserved covariates that may affect assignment to the treatment and the conditional independence assumption, by performing Rosenbaum bounds sensitivity test (Rosenbaum, 2002; Caliendo & Kopeinig, 2008). Note however that, the nearest neighbor corrected bias estimator of Abadie et al. (2004), is robust to these biases and also correct for heteroskedastic-robust variance error, that made it more suitable later on, for our estimations and inference (Abadie et al., 2004).

Following Rosenbaum and Rubin (1985a), the standardized bias p-values that assess the absence of distance in marginal distributions of the covariates between treated and control units, support the absence of statistical differences in covariates, after matching between treated and control units at 5% significance level. And yet, the pseudo-R2 of Sianesi (2004) that also indicates how well the regressors explain the participation probability after matching, are fairly low, suggesting that matching well removes differences in covariates distribution between treated and untreated units and provided well balanced scores. And finally, the presence of unobserved covariates that may bias the propensity score, performed with the Rosenbaum upper bound sensitivity test at the usual 5% significance level under the assumption of an overestimated ATT, is within the accepted limits comparable with existing studies (Rosenbaum, 2002). Thus, estimations are also robust with respect to the conditional independence assumption and to the absence of hidden bias (Rosenbaum, 2002).

Given these diagnostic tests, our benchmark results reported in table 3.2, irrespective to the matching method, suggest that WAEMU countries gain in average near 4% of efficient mobilization of resources in the area as compared to their counterfactual. This result is given in column 3 of table 3.2, while considering the nearest neighbor corrected bias estimator of Abadie et al. (2004) with 3 neighbors. The estimated standardized average treatment effect on the treated (SATT) is statistically significant at 1% conventional level, showing that this effect did not happen by chance.

Table 3.2: Average treatment effects: ATT estimates, efficiency score

	Nearest neighbor			Radius matching			Kernel matching	Local linear regression matching
	N=1	N=2	N=3	r=0.005	r=0.01	r=0.05	Kernel	LLR
VARIABLES	Efficiency_score	Efficiency_score	Efficiency_score	Efficiency_score	Efficiency_score	Efficiency_score	Efficiency_score	Efficiency_score
ATT	0.0915***	0.0601**	0.0587**	0.0420*	0.0436*	0.0470**	0.0450***	0.0512**
	(0.0297)	(0.0278)	(0.0280)	(0.0244)	(0.0240)	(0.0206)	(0.0160)	(0.0217)
Observations	544	544	544	544	544	544	544	544
No treated	88	88	88	88	88	88	88	88
No controls	456	456	456	456	456	456	456	456
Pseudo R2	0.017	0.005	0.006	0.010	0.008	0.006	0.006	0.017
Standardized bias (pvalue)	0.95	1.00	0.99	0.99	0.99	0.99	0.99	0.95
Rosenbaum bounds sensitivity tests	1.9	1.55	1.6	2	1.4	1.7	1.65	1.75

Standard errors in parentheses

	Nearest neighbor corrected bias	Nearest neighbor corrected bias	Nearest neighbor corrected bias
	NN=1	NN=2	NN=3
VARIABLES	Efficiency_score	Efficiency_score	Efficiency_score
SATT	0.0548***	0.0594***	0.0398***
	(0.00117)	(0.00393)	(0.00583)
Observations	544	544	544
No treated	88	88	88
No controls	456	456	456

Standard errors in parentheses

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

In the next section (section 6.3) we ask whether this efficient mobilization of resources achieved in WAEMU countries under this reform agenda is leading to effective business climate outlooks as a consequence.

3.6.3 Is the reform leading to effective business climate outlooks?

One of the key aspects considered by firms in doing businesses (business creation and formalization) is also taxation (Rocha et al., 2014). In this vein, we asked the following question: is the tax transition reform program, that gives rise to a vast project of tax harmonization and coordination in WAEMU countries, resulting in doing business performance? Is the achieved efficient collection of taxes under this reform agenda, improving tax oriented business climate considerations in the union as compared to other Sub-Saharan African countries?

It must be noted that in order to succeed with this reform agenda, WAEMU countries take steps towards harmonizing and coordinating their direct and indirect tax rules consultable in the agreements 01/98/CM/UEMOA concerning the harmonization of domestic indirect taxation and 16/2006/CM/UEMOA concerning the harmonization of direct taxation (Diakite et al., 2017b; Mansour & Rota-Graziosi, 2013). The harmonization and coordination of tax rules might also increase efficiency in collecting taxes, by reducing collection costs, and increasing firms' contribution rate, for example. To answer these questions, we made use of tax oriented Doing Business indicators (2020) provided by the World Bank to test the effect of the reform notably on the contribution rate score of firms, and time to comply with tax rules and tax obligations. The total tax and contribution rate measures the amount of taxes and mandatory contributions paid by the business in the second year of operation, expressed as a percentage of profit while the time required to comply with tax laws measures the time it takes to prepare and pay main types of taxes: corporate tax, value-added or sales tax, and labor taxes. The scores are indicated on a scale of 0 to 100, where 0 represents the worst regulatory performance and 100 the best regulatory performance. The contribution rate score of firms and time to comply with tax rules and tax obligations are therefore our new outcome variables in the PSM approach. Results are given in table 3.3 and table 3.4.

Our results suggest that, the tax transition reform program is increasing firm's contribution rates and reducing tax collection costs, by reducing times firms need to comply with tax laws and tax obligations in these countries. We found in table 3.3 while using the nearest neighbor corrected bias estimator of Abadie et al. (2004) with 3 neighbors for example that, WAEMU countries overall gain near 22 places while benchmarking countries with respect to the best practice on contribution rate of firms, and collection costs also decreased by 4 scales also while benchmarking countries with respect to the best practice on collection times. This later result is provided in table 3.4, and results are most significant at 1% significance level.

Table 3.3: Average treatment effects: ATT estimates, contribution rate score

	Nearest neighbor			Radius matching			Kernel matching	Local linear regression matching
	N=1	N=2	N=3	r=0.005	r=0.01	r=0.05	Kernel	LLR
VARIABLES	Contribution_rate	Contribution_rate	Contribution_rate	Contribution_rate	Contribution_rate	Contribution_rate	Contribution_rate	Contribution_rate
ATT	23.56***	25.71***	23.54***	22.24***	22.27***	20.57***	20.63***	20.42***
	(6.761)	(6.083)	(7.601)	(6.653)	(5.853)	(5.187)	(4.458)	(3.763)
Observations	352	352	352	352	352	352	352	352
Observations	352	352	352	352	352	352	352	352
No treated	88	88	88	88	88	88	88	88
No controls	264	264	264	264	264	264	264	264
Pseudo R2	0.130	0.088	0.077	0.044	0.049	0.050	0.052	0.130
Standardized bias (pvalue)	0.001	0.024	0.052	0.689	0.464	0.304	0.265	0.001
Rosenbaum bounds sensitivity tests	2.5	6	6.5	3.5	6.5	12	11.5	15.5

Standard errors in parentheses

	Nearest neighbor corrected bias	Nearest neighbor corrected bias	Nearest neighbor corrected bias
	NN=1	NN=2	NN=3
VARIABLES	Contribution_rate	Contribution_rate	Contribution_rate
SATT	28.37***	24.82***	21.91***
	(1.529)	(2.092)	(1.738)
Observations	352	352	352
No treated	88	88	88
No controls	264	264	264

Standard errors in parentheses

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

Table 3.4: Average treatment effects: ATT estimates, Time score

	Nearest neighbor			Radius matching			Kernel matching	Local linear regression matching
	N=1	N=2	N=3	r=0.005	r=0.01	r=0.05	Kernel	LLR
VARIABLES	Time_score	Time_score	Time_score	Time_score	Time_score	Time_score	Time_score	Time_score
ATT	-4.936	-1.533	-1.624	-5.628	-2.429	-2.537	-2.360	-2.807
	(5.515)	(4.956)	(5.036)	(6.420)	(6.442)	(5.350)	(4.292)	(4.325)
Observations	352	352	352	352	352	352	352	352
No treated	88	88	88	88	88	88	88	88
No controls	264	264	264	264	264	264	264	264
Pseudo R2	0.142	0.107	0.108	0.064	0.074	0.088	0.093	0.142
Standardized bias (pvalue)	0.003	0.027	0.027	0.733	0.370	0.089	0.063	0.003
Rosenbaum bounds sensitivity tests	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5

Standard errors in parentheses

	Nearest neighbor corrected bias	Nearest neighbor corrected bias	Nearest neighbor corrected bias
	NN=1	NN=2	NN=3
VARIABLES	Time_score	Time_score	Time_score
SATT	-6.170***	-4.734***	-4.210***
	(0.158)	(0.773)	(0.948)
Observations	352	352	352
No treated	88	88	88
No controls	264	264	264

Standard errors in parentheses

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

3.6.4 What are the main performing channels of the reform?

Having highlighted the positive effects of the reform on the efficiency of tax collection, the time needed to collect tax and the contribution rate of firms, it is important to identify the channels of its effectiveness for improvement policies. We therefore test for two main channels through which we suspect the reform to be at work. The channel of tax morale and tax compliance (tax discipline). For the first channel we aim at testing whether the reform leads to transparency in taxpayers' obligations and liability, the one we call for simplicity "tax morale", and the second channel, if the reform is leading to effectiveness in registration measures and effectiveness in audit and control procedures, that we call "tax compliance" for simplicity. Data used in reaching such objectives are provided in PEFA (Public expenditure and financial accountability) rating of countries, through assessment of the quality of their Public Financial Management (PFM). PEFA ratings are broadly concerned about country performance on budgetary outcomes including tax revenue collection outcomes. Countries are noted in several dimensions of their public finance ranging from a score of A to D. We re-parameterize these scores from 0 to 3. We made use of PEFA 2006 and 2011 indicators framework, notably the pillars 13 (transparency of taxpayer obligations and liability), 14 (effectiveness of measures for taxpayers registration and tax assessment), and 21 (effectiveness of audit and control measures) to reach our objectives. But data on these variables are very scarce. We then take the mean of such scores along our period of study to have a cross-section available data for the year 2016. We then re-estimate the effect of announcing the reform on those dimensions of countries' public financial management taxation based using PSM. Results are given in table 3.5; 3.6 and 3.7 where we report only estimation based on Abadie et al. (2004) corrected bias estimator.

We show that, the main channel through which the reform is performing is "tax compliance" rather than "tax morale". Our results in table 3.5 suggest that, WAEMU countries do not increase "tax morale" as a consequence of announcing this reform as compared to other African countries. In other words, transparency and liability in taxpayers' obligations are more relevant in other African countries than in WAEMU countries. The announcement and implementation of this reform does not succeed in bringing overall "tax morale" in these countries. However, in table 3.6 we found concerning the variable of effectiveness in registration measures that, the reform increases this dimension in WAEMU countries as compare to their counterfactual, which suggests that the reform is well working through tax compliance (tax discipline). The same result is found in table 3.7 concerning the variable of effectiveness in audit and control procedures. These results are broadly significant at 1% significance level, telling as that, the main channel through which the efficient mobilization of resources is achieved is through "tax compliance" rather than "tax morale".

Table 3.5: Average treatment effects: ATT estimates, transparency and liability in taxpayers' obligations

	Nearest neighbor corrected bias	Nearest neighbor corrected bias	Nearest neighbor corrected bias
	N=1	N=2	N=3
VARIABLES	transp_liab	transp_liab	transp_liab
SATT	-0.439	-1.021***	-0.592**
	(0.352)	(0.263)	(0.278)
Observations	32	32	32
No treated	8	8	8
No controls	24	24	24

Standard errors in parentheses

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

Table 3.6: Average treatment effects: ATT estimates, effectiveness of registration measures

	Nearest neighbor corrected bias	Nearest neighbor corrected bias	Nearest neighbor corrected bias
	N=1	N=2	N=3
VARIABLES	Effect_registration	Effect_registration	Effect_registration
SATT	0.425	1.260***	1.125***
	(0.307)	(0.326)	(0.307)
Observations	32	32	32
No treated	8	8	8
No controls	24	24	24

Table 3.7: Average treatment effects: ATT estimates, effectiveness of audits and controls

	Nearest neighbor corrected bias	Nearest neighbor corrected bias	Nearest neighbor corrected bias
	N=1	N=2	N=3
VARIABLES	Effect_audit	Effect_audit	Effect_audit
SATT	0.402	1.412***	1.583***
	(0.315)	(0.259)	(0.225)
Observations	32	32	32
No treated	8	8	8
No controls	24	24	24

3.7 Sensitivity analyses

To reinforce the validity of our results, we perform some sensitivity analyses. First, we test for the effect of having some specific tax reform such as the adoption of value-added tax (VAT), large taxpayers' units (LTUs), or semi-autonomous revenue agencies (SARAs) in achieving revenue efficiency under the reform agenda. Second, we rely on an alternative evaluation impact technique, namely the synthetic control method. Finally, we perform a placebo test.

3.7.1 Does specific tax reform matter?

Three important innovative reforms have also revolutionized tax policy and tax administration in developing countries : the adoption of value-added tax (VAT), the implementation of large taxpayers' units (LTUs), and the adoption of semi-autonomous revenue agency (SARAs). These reforms have dramatically changed the way tax revenues are collected in countries. They have also demonstrated contagious effects with following reforms including tax transition reforms in concerned countries. While the first reform broadly concerns a tax policy innovation, LTUs and SARAs are more tax administration based. The introduction of LTUs contributes to the effort of rationalizing tax administration by consolidating all its functions under one umbrella for large taxpayers. It consists in establishing a self-contained office within the tax administration, acting as a single window for large taxpayers on domestic revenue collection (Baer et al., 2002; Fossat & Bua, 2013). SARAs are also drastic reforms consisting in delegating tax collection to an autonomous and independent revenue agency. It isolates revenue collection from political forces, provides management autonomy, and merges custom revenue collection function and tax administration function into a single entity (Fjeldstad & Moore, 2009; Kloeden, 2011). These reforms are also efficiency improving by the way revenues are collected, and are almost times adopted before or after the tax transition reform in developing countries. In WAEMU countries, for example, the adoption of VAT was prior to the tax transition reform program, as well as the implementation of LTUs. We assume that these reforms may significantly contribute to improving efficient revenue mobilization in these countries and therefore constitute important "omitted variable bias" in the model.

We then re-compute our propensity scores by including these variables in the model. We re-calculate the probability that countries have to adopt the tax transition reform once VAT, LTUs and SARAs have been adopted, and then re-estimate the effect of the tax transition reform program on the efficiency of collecting revenue. Results are given in table 3.8.

Our results overall suggest that the adoption of SARAs and VAT, are the main factors that have contributed to foster the effect of tax transition reform program on efficient mobilization

of resources in WAEMU countries. The estimated ATT are well above the one obtained without including these variables in the model, and results are significant at 1% significance level. Results are presented also with reference to the nearest neighbor corrected bias estimator of Abadie et al. (2004) in its column 3.

Table 3.8: Average treatment effects: ATT estimates, efficiency score and more control variables

	Nearest neighbor			Radius matching			Kernel matching	Local linear regression matching
	N=1	N=2	N=3	r=0.005	r=0.01	r=0.05	Kernel	LLR
VARIABLES	Efficiency_score	Efficiency_score	Efficiency_score	Efficiency_score	Efficiency_score	Efficiency_score	Efficiency_score	Efficiency_score
ATT	0.0915***	0.0601**	0.0587**	0.0420*	0.0436*	0.0470**	0.0450***	0.0512**
	(0.0297)	(0.0278)	(0.0280)	(0.0244)	(0.0240)	(0.0206)	(0.0160)	(0.0217)
Vat adoption	0.0558	0.0569*	0.0632**	0.0533*	0.0601**	0.0582**	0.0567***	0.0618***
	(0.0399)	(0.0301)	(0.0307)	(0.0280)	(0.0283)	(0.0226)	(0.0206)	(0.0215)
LTU	0.0928**	0.0902***	0.0836**	0.0713**	0.0578**	0.0514**	0.0506**	0.0510**
	(0.0373)	(0.0309)	(0.0357)	(0.0327)	(0.0290)	(0.0254)	(0.0222)	(0.0232)
SARA	0.119***	0.134***	0.128***	0.111***	0.114***	0.125***	0.124***	0.125***
	(0.0413)	(0.0351)	(0.0368)	(0.0371)	(0.0292)	(0.0307)	(0.0210)	(0.0303)
Observations	544	544	544	544	544	544	544	544
No treated	88	88	88	88	88	88	88	88
No controls	456	456	456	456	456	456	456	456
Pseudo R2	0.085	0.062	0.074	0.052	0.053	0.037	0.038	0.085
Standardized bias (pvalue)	0.090	0.314	0.171	0.780	0.561	0.766	0.748	0.090
Rosenbaum bounds sensitivity tests	2.45	6	4	2.5	3.5	5	5	5.5

Standard errors in parentheses

	Nearest neighbor corrected bias	Nearest neighbor corrected bias	Nearest neighbor corrected bias
	NN=1	NN=2	NN=3
VARIABLES	Efficiency_score	Efficiency_score	Efficiency_score
SATT	0.0548***	0.0594***	0.0398***
	(0.00117)	(0.00393)	(0.00583)
Vat adoption	0.0548***	0.0594***	0.0400***
	(0.00117)	(0.00393)	(0.00687)
LTU	0.0377***	0.0346***	0.0264***
	(0.00117)	(0.00419)	(0.00599)
SARA	0.168***	0.132***	0.128***
	(0.00140)	(0.00436)	(0.00694)
Observations	544	544	544
No treated	88	88	88
No controls	456	456	456

Standard errors in parentheses

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

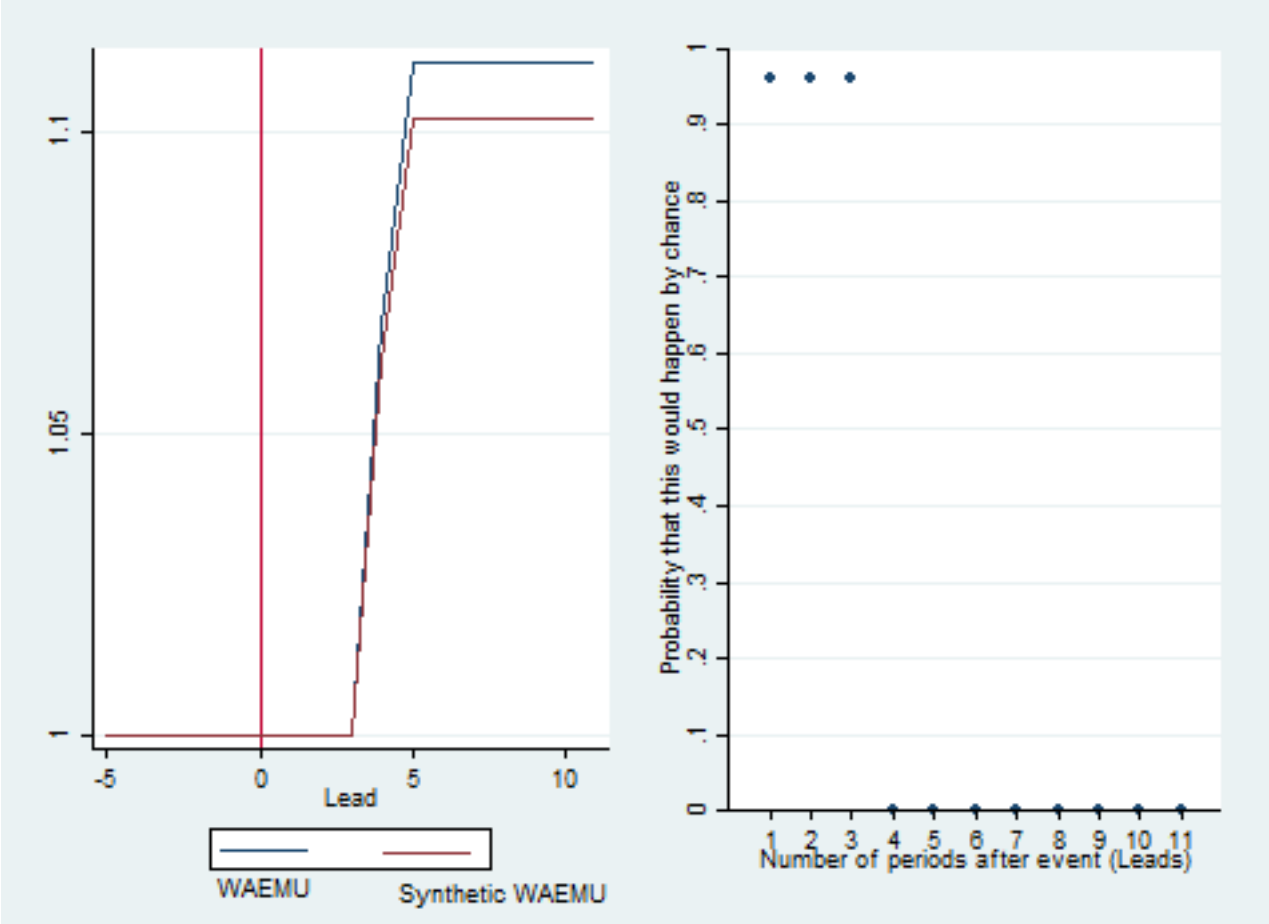
3.7.2 Using synthetic control method

In this section we aim to deepen the results that we obtained with the propensity score matching by considering another way of constructing the counterfactual. We apply here the synthetic control method (SCM) developed by Abadie and Gardeazabal (2003) and extended in Abadie et al. (2010); Abadie et al. (2015); and Abadie (2019); to investigate the effect over time of the studied tax reform on efficient mobilization of resources. The SCM constructs a weighted combination of potential control countries to approximate the most relevant characteristics of countries affected by the reform. The advantage of this approach lies in the transparent way of estimating the counterfactual outcome of the treated countries, namely, a linear weighted combination of untreated countries. The countries that form the synthetic control are selected by an algorithm based on their similarity to the treated countries before the treatment with respect to relevant covariates (Abadie & Gardeazabal, 2003).

Another important advantage of the SCM is that unlike most previous estimators used in the literature, it can deal with endogeneity from omitted variables bias by accounting for the presence of time-varying unobservable heterogeneities. This improves the diff-in-diff models framework, that can account only for time-invariant unobservable confounders. Within the SCM framework, we ask whether the adoption of tax transition reform program in WAEMU countries leads to efficient revenue mobilization in years following the reform as compare to previous years where the reform was not yet implemented. Results are provided in graph 3.

We found that the reform is at work mostly 3 years after it was announced in the union. The efficient revenue collection highlighted with the propensity score was achieved 3 years following the adoption of this reform, the year in which institutional arrangements for monitoring the implementation of the reform were emplaced in these countries (2009). Before that year, we found an insignificant effect of the reform on revenue collection efficiency given by p-values above conventional levels. By the year 2009, the estimated p-values are close to zero, and WAEMU countries started recovering efficiency as compare to their counterfactual.

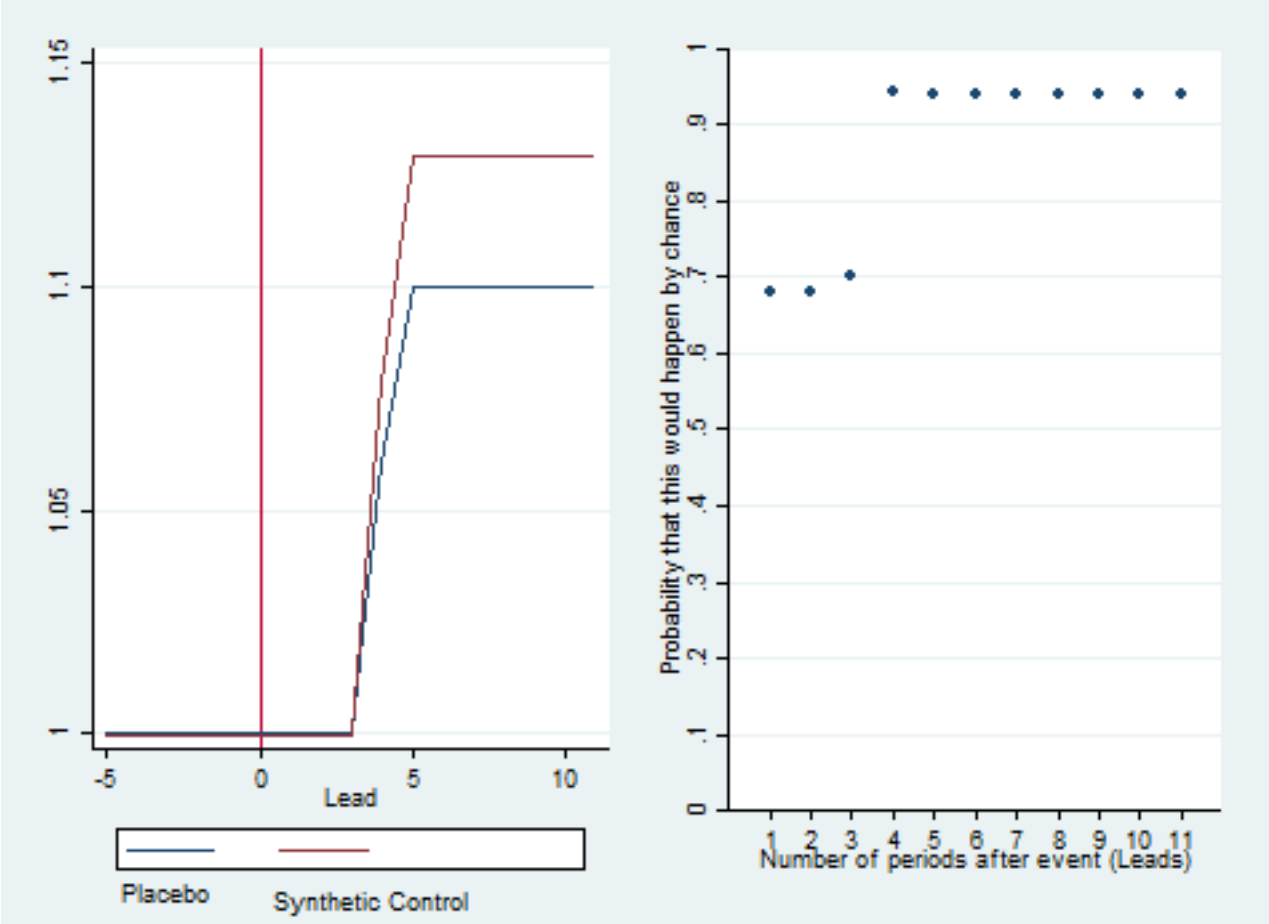
Graph 3: Synthetic control method estimation



3.7.3 Performing placebo tests

In this section we wonder if our estimated effect on WAEMU countries are purely due to chance. We conduct "in space placebo test" allowing to treat other Sub-Saharan African countries in the same time period as the ones that have substantially announced the reform nor WAEMU countries. It represents such a way to validate or reject our estimated ATT effects on WAEMU countries. Results are given in graph 4. We found a negative and insignificant effect of the adoption of the reform in placebo countries as compared to WAEMU countries. This result suggests that our positive effects on revenue collection efficiency due to the reform program, are purely due to WAEMU countries.

Graph 4: Synthetic control method estimation: Placebo test.



3.8 Conclusion

Like other developing countries (DCs), WAEMU countries are facing a sharp drop in their tariff revenues as a result of trade liberalization and regional integration policies designed to better participate in the world economy. To mitigate these effects, tax transition programs are ambitious tax reform programs suggested by international financial institutions (World Bank, International Monetary Fund) to developing countries which consists of replacing border taxes with domestic taxation and recouping revenue losses from trade liberalization through efficient domestic revenue collection. WAEMU countries, for their part, have broadly appropriated this reform in "the jure" and in "de facto" narratives since the adoption of their common external tariff in the 2000s. This led these countries to establish transparent and inclusive tax systems in order to succeed with this reform agenda. While the theoretical literature underlying this reform remains disputed on the effectiveness of such reform in developing countries regarding the size of the informal sector and governments administrative costs in enforcing and collecting domestic taxes, WAEMU countries' tax reform agenda provides a suitable opportunity to empirically test the issue. After several years of announcement and implementation of this reform at the community level, it is important to analyze its effects on the efficiency of tax revenue collection

as well as key indicators of the business climate in these countries. This analysis could provide useful lessons for the monitoring of this reform in order to maximize the expected benefits. This paper has attempted to evaluate the reform by assessing its effectiveness in improving tax collection efficiency and some doing business indicators in WAEMU countries.

The study is based on impact assessment methods, in particular the propensity score matching (PSM) approach and the synthetic control method (SCM). The results of our estimates confirm positive impacts of the reform in the sense that the announcement and implementation of this reform leads to more efficient mobilization of resources in these countries as compared to their counterfactual. In addition, the reform has also shown the means of improving tax-oriented doing business indicators in these countries, by reducing collection costs and increasing the effective contribution rate of firms. These results have implications for the further implementation of these reforms in WAEMU countries. On the one hand, they show the need to pursue this reform more rigorously in order to enhance its positive effects. On the other hand, the community monitoring and surveillance system put in place by these countries starting in 2009 must be improved in order to ensure the compensation of trade tax losses that would result from the implementation of future trade agreements such as the African Continental Free Trade Area (AfCFTA). Moreover, the relative success of this reform in the WAEMU zone suggests that this reform is desirable for countries in a broader sense, since it increases domestic tax discipline in the face of tariff cuts, but also help modernize domestic tax administration to ensure well designed and inclusive tax systems efficiency-oriented.

On the channels through which the reform would improve the efficiency of tax collection, the results showed that tax compliance is the main channel through which the reform is performing while the tax morale channel is not yet operating. These results suggest the maintenance and improvement of the best practices promoted by the reform, such as the modernization of tax administrations, the use of new information and communication technologies, the improvement of the tax collection and control system, and the constant capacity-building of the human resources of the tax and customs administrations. The limited impact of the reform on tax citizenship (tax morale) suggests recommendations for corrective measures and incentives such as promoting fiscal education of taxpayers, good governance and the fight against corruption. In the same framework, the results highlight the need for WAEMU countries to increase their reputation and credibility in order to gain the confidence of taxpayers by perceiving their tax burden as fair and contributing to the economic development of member countries.

Appendix 1

To compute efficiency scores, we use the stochastic frontier method (SFM). Note that, the SFM model was first proposed by Aigner et al. (1977) for modelling production and technical efficiency of firms. The production function basically predicts the maximum of output that a firm can reach according to inputs. Several generations of authors handle with the SFM model in the literature with various interpretations and formulations of the efficiency scores.

The difference between the SFM and traditional econometric methods relies on the specification of the error term, which can be divided into many parts according to the interested model.

The first generation of SFM models relies on a time- invariant technical efficiency, that can be estimated through a fixed effect model Schmidt and Sickles (1984) or a random effect model (Pitt & Lee, 1981; Kumbhakar, 1987; Battese & Coelli, 1988). The model is :

$$logY_{it} = \alpha_0 + f(logX_{it}; \beta) + \xi_{it} \tag{3.4}$$

$$\xi_{it} = vit - \mu_i \tag{3.5}$$

$log(Y_{it})$ is the logarithm of tax revenue to GDP, $log(X_{it})$ is the vector of inputs in logarithm (vector of structural factors that determine tax revenue namely GDP per capita, agricultural ratio, trade openness, and resource rents). The error term in this model is decomposed into two parts: υ_{it} corresponds to the random noise and μ_i is the inefficiency term, which is time-invariant and specific to each country and independently distributed.

But we rather estimate efficiency scores following the second generation technical efficiency models notably the one of Kumbhakar et al. (2014) that takes into account time-variant components of technical efficiency. Basically, time-varying technical efficiency models release the assumption of invariability of the efficiency term over time. A country can improve its tax performance over time through a tax reform for example. The particularity of the Kumbhakar et al. (2014) model is also that, it can distinguish between persistent and residual technical efficiency. Thus, the model allows the error term to be divided into many components : the random noise, countries unobserved heterogeneities which capture time-invariant heterogeneities, persistent technical efficiency relating to tax law stability, for example, and residual technical efficiency due to tax administration. The model is:

$$logY_{it} = \alpha_0 + f(logX_{it}; \beta) + \xi_{it} \tag{3.6}$$

$$\xi_{it} = vit - \mu_{it} \tag{3.7}$$

$$\mu_{it} = \mu_i + \lambda_{it} \tag{3.8}$$

Finally, overall efficiency score, is the product of persistent technical efficiency by the residual technical efficiency and this approach is used in this paper.

Appendix 2

Table 3.9: Efficiency scores

	2000	2002	2004	2006	2008	2010	2012	2014	2016
BDI	.9631195	.9631193	.9631193	.9631193	.9631196	1	1	1	1
BEN	.5180938	.5180936	.5180936	.5180936	.5180939	.5505661	.5505661	.5505661	.5505661
BFA	.606456	.6064556	.6064556	.6064556	.6064561	.6718686	.6718686	.6718686	.6718686
CAF	.473072	.4730718	.4730718	.4730718	.4730721	.5163375	.5163375	.5163375	.5163375
CIV	.4421676	.4421674	.4421674	.4421674	.4421677	.4785143	.4785143	.4785143	.4785143
CMR	.425883	.4258828	.4258828	.4258828	.4258831	.4583966	.4583966	.4583966	.4583966
COG	.1670617	.1670616	.1670616	.1670616	.1670618	.2009961	.2009961	.2009961	.2009961
COM	.3645481	.3645479	.3645479	.3645479	.3645481	.3957038	.3957038	.3957038	.3957038
CPV	.3052295	.3052295	.3052295	.3052295	.3052296	.3214419	.3214419	.3214419	.3214419
ETH	.7147894	.7147892	.7147892	.7147892	.7147894	.7429038	.7429038	.7429038	.7429038
GHA	.4474123	.4474121	.4474121	.4474121	.4474124	.4817308	.4817308	.4817308	.4817308
GIN	.2811562	.2811559	.2811559	.2811559	.2811564	.3382292	.3382292	.3382292	.3382292
GMB	.4524565	.4524561	.4524561	.4524561	.4524567	.5279514	.5279514	.5279514	.5279514
GNB	.2974881	.2974878	.2974878	.2974878	.2974883	.3655483	.3655483	.3655483	.3655483
KEN	.5429861	.5429859	.5429859	.5429859	.5429862	.5794976	.5794976	.5794976	.5794976
LSO	.9341857	.9341856	.9341856	.9341856	.9341858	.9624549	.9624549	.9624549	.9624549
MDG	.4480968	.4480966	.4480966	.4480966	.4480968	.4788191	.4788191	.4788191	.4788191
MLI	.5332444	.5332442	.5332442	.5332442	.5332445	.5714422	.5714422	.5714422	.5714422
MOZ	.5124094	.5124088	.5124088	.5124088	.5124097	.6410457	.6410457	.6410457	.6410457
MRT	.4384412	.438441	.438441	.438441	.4384412	.4667821	.4667821	.4667821	.4667821
MWI	.5062375	.5062371	.5062371	.5062371	.5062377	.5940957	.5940958	.5940958	.5940958
NER	.5907948	.5907944	.5907944	.5907944	.590795	.6579003	.6579003	.6579003	.6579003
RWA	.6002675	.6002672	.6002672	.6002672	.6002675	.6340299	.6340299	.6340299	.6340299
SDN	.2599533	.2599532	.2599532	.2599532	.2599533	.2741945	.2741945	.2741945	.2741945
SEN	.4965483	.496548	.496548	.496548	.4965484	.5451521	.5451521	.5451521	.5451521
SLE	.4978291	.4978289	.4978289	.4978289	.4978291	.5276248	.5276248	.5276248	.5276248
TCD	.2387312	.238731	.238731	.238731	.2387312	.2680245	.2680245	.2680245	.2680245
TGO	.6385971	.6385968	.6385968	.6385968	.6385974	.7199318	.7199318	.7199318	.7199318
TZA	.4087689	.4087687	.4087687	.4087687	.408769	.4468982	.4468982	.4468982	.4468982
UGA	.4947559	.4947558	.4947558	.4947558	.494756	.5159272	.5159272	.5159272	.5159272
ZMB	.423654	.423654	.423654	.423654	.423654	.4339311	.4339311	.4339311	.4339311
ZWE	.3738306	.3738302	.3738302	.3738302	.3738309	.4705626	.4705626	.4705626	.4705626

Appendix 3

List of countries.

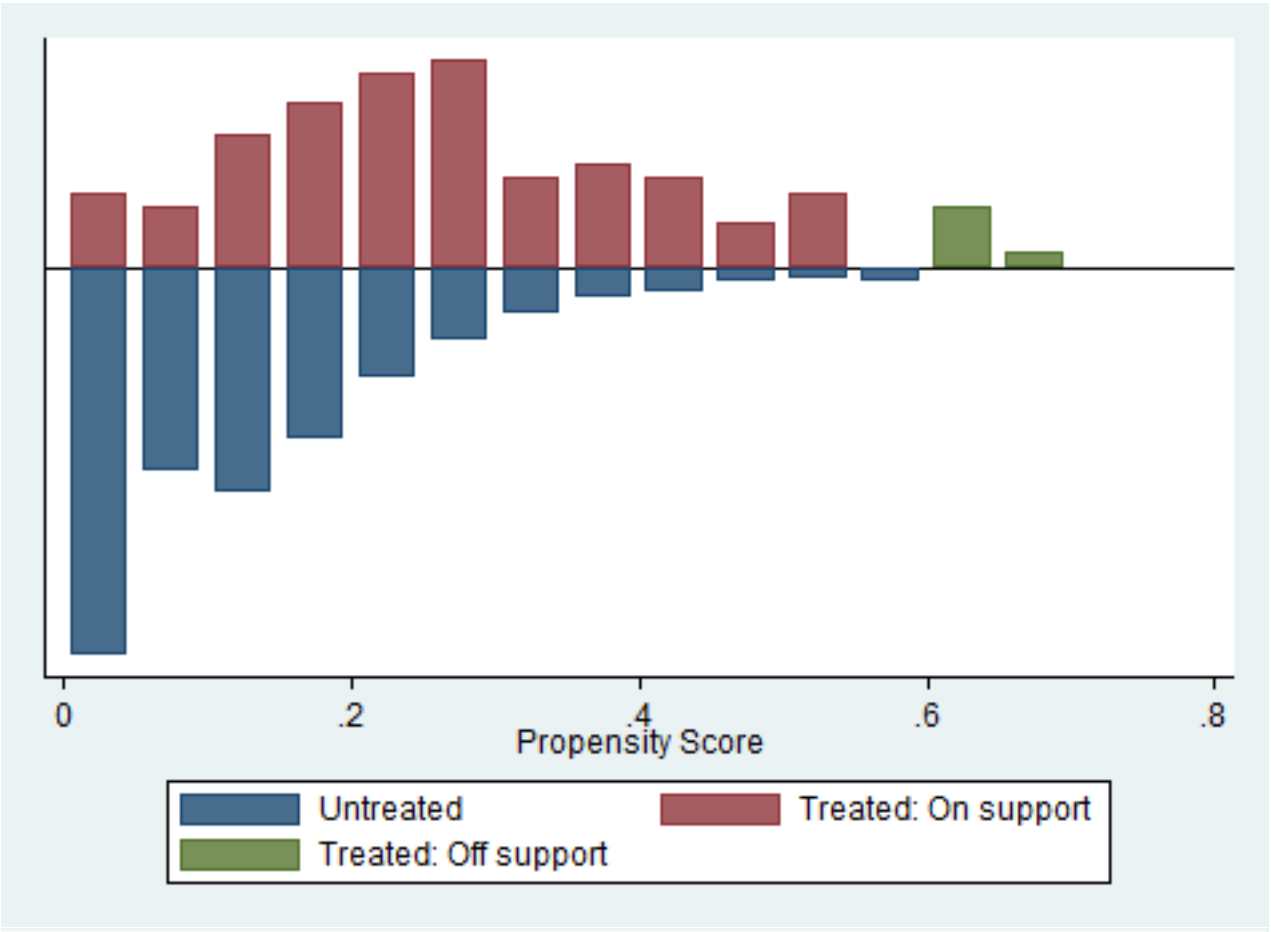
Burundi Benin Burkina Faso Central African Republic Cote d'Ivoire Cameroon Congo Republic Comoros Cabo Verde Chad Ethiopia Ghana Guinea Gambia Guinea Bissau Kenya Lesotho Madagascar Mali Mozambique Mauritania Malawi Niger Rwanda Sudan Senegal Sierra Leone Togo Tanzania Uganda Zambia Zimbabwe.

Appendix 4

Table 3.10: Descriptive statistics

	Obs	Mean	Std dev	Min	Max
Tax reform	544	.1617647	.3685737	0	1
Non resource tax	544	13.04241	6.427095	2.142618	53.86848
Trade tax	544	3.27013	4.002213	.1715756	36.11561
Domestic tax	544	9.772277	4.100184	1.389354	28.70767
Gdp capita	544	929.2127	632.3133	194.8731	3532.14
Trade	544	64.51662	27.53377	19.1008	165.6459
Agriculture	544	27.37643	12.30833	3.383113	58.65189
Natural resources	544	12.19035	10.46034	.4142639	59.61957
Financial development	544	.1051923	.0393634	.0016545	.2578382
Internet ratio	544	5.216956	7.437017	.0152638	50.32282
Population size	544	1.59e+07	1.66e+07	428188	1.04e+08
Transparency and liability	60	1.7	.787616	0	3
Democratic accountability	544	3.393382	1.072134	0	5.5
Socioeconomic conditions	544	3.171875	.9836848	.5	7
Effectiveness registration measures	60	.3	.645716	0	2
Effectiveness audit	62	.7419355	.6759446	0	2
Corruption	544	2.05239	.7372084	0	4
Time score	352	57.56604	26.39752	0	92.11747
Contribution rate score	352	63.53547	29.78511	0	100
Human development index	544	.4421066	.0762944	.253	.645
Vat adoption	544	.8878676	.3158196	0	1
LTU	544	.5386029	.4989664	0	1
SARA	544	.3952206	.489348	0	1

Appendix 5 Common support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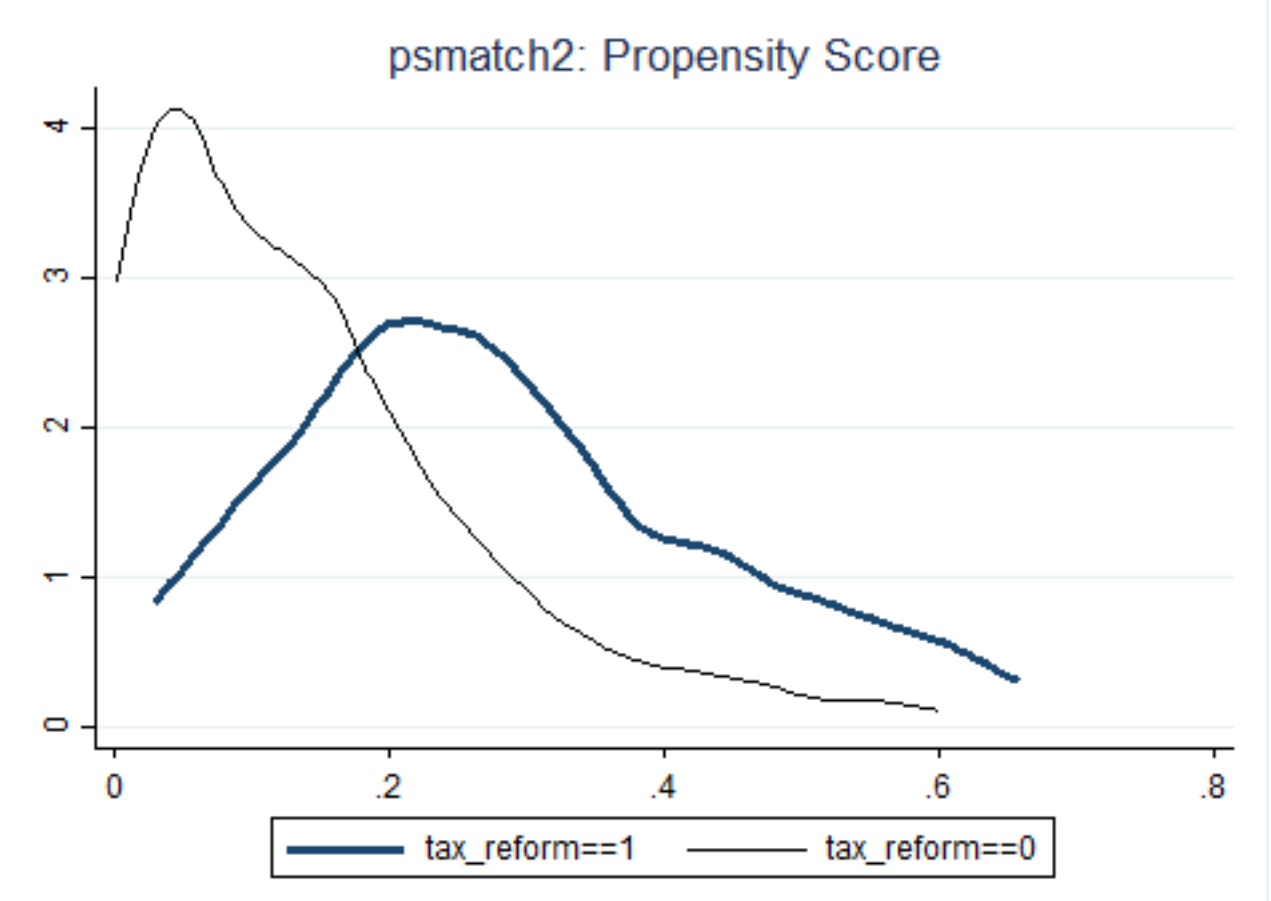
.2
.4
.6
.8
Propensity Score
Untreated
Treated: On support
Treated: Off support


psmatch2: Propensity Score
0
1
2
3
4
0
.2
.4
.6
.8
tax_reform==1
tax_reform==0

Chapter 4

Social impact of VAT based tax-transition: The case of Togo.

Abstract

Does the tax system of developing countries absorb tax transition reforms based on VAT? This paper attempts to answer the question by assessing the distributional and poverty consequences of VAT based tax-tariff reforms stationed on the case of Togo. Building on a computable general equilibrium model of tax changes coupled with a microsimulation framework, the paper evidences that VAT based tax-tariff reform implemented at the country level is poverty and inequality increasing. A point for point increase in VAT to compensate for trade tax revenues with the actual VAT rate of 18% enlarges poverty at this country level. Nonetheless, a low VAT rate of 15%, with exemption of agricultural goods from VAT coverage is found to have preferred poverty consequences. Notwithstanding, the analysis reveals that non-farmers households are the ones that encounter the greatest increase in poverty incidence following the reform, as compare to farmers. Yet, disaggregating households according to their residence place also reveals the interesting result that, poverty is urban-based within the group of farmers, while at the same time is rural-based within the group of non-farmers. The paper also points out that, targeted social transfers to households with revenue brought by the reform, may counteract the poverty rising effect of the reform, while dealing with inequality to some extent.

Keywords: VAT-trade tax reform, Distributional impact, Poverty impact, Togo.

JEL code: H20

4.1 Introduction

Tax reforms have been promoted by international financial institutions as an important component of general economic reforms in many developing countries. One of the advocated reforms includes a shift[1] from border taxes, to domestic sale taxes especially value-added tax (VAT). VAT has been the main trade tax revenue recovery instrument following trade liberalization, and is widely used in a majority of countries. Part of research has been carried out to provide evidence on the revenue compensating effect of VAT and if the revenue replacement strategy is well functioning (Baunsgaard & Keen, 2010; Waglé, 2011; Crivelli et al., 2016; Adandohoin, 2018). However, little research has been done to identify the social impact of more reliance on VAT as a tax-tariff reform device.

A major concern about more extensive use of VAT in national tax systems often arises from its regressivity over income (Gastaldi et al., 2017). This statement is based on the fact that, the share of income that households spend in consumption, is decreasing in income (Carlson & Patrick, 1989). Poorest households spend a greater proportion of their income in consumption as compared to high income households. In such circumstance, VAT would most affect the poor than the rich because of the ability to save for the latter (Poh, 2003). VAT is a revenue mobilization tool in favour of economic efficiency but underperforming in terms of equity (Poh, 2002).

Nonetheless, studies that emphasized the regressivity of VAT are inconclusive. According to Jenkins et al. (2006), the claim has not taken into account the fact that, in many developing countries, the commodities on which poor households spend most of their income, even if included in the legal tax base, are administratively impractical to tax. In such context, the effective VAT rate borne by each household, would be naturally progressive over quintiles of household expenditures. Other authors emphasized more discourses about the regressivity of VAT by highlighting the fact that, border taxes that VAT has replaced could have been more regressive[2] (Clarete & Whalley, 1986; Gemmell & Morrissey, 2005). And yet, studies that emphasized coordinated VAT-tariff reforms, come to the evidence of a welfare increasing effect of the revenue replacement strategy (Michael et al., 1993; Hatzipanayotou et al., 1994; Abe, 1995; Keen & Ligthart, 2002a; Naito, 2006; Keen, 2008).

In theory, direct taxation should best preserve equity, but its revenue raising power is limited in many developing countries. As stated in R. M. Bird and Zolt (2005), personal income tax

[1] This phenomenon is called tax transition, or tax-tariff reform, and VAT-trade tax reform in this case. The aim is to offset revenue losses on international trade due to trade liberalization, with domestic revenues most times VAT based.

[2] Tariffs have larger distorting effects. They distort both production and consumption decisions, whereas an imperfect VAT would distort only consumption decisions.

has done little to reduce inequality in many developing countries given that, in these countries, this tax is neither comprehensive nor very progressive. It often amounts to little more than withholding tax on wages in the formal sector. So, given the dominance of consumption taxes in the tax system of developing countries, concerns about fairness and social justice fall back on VAT, which must ensure both revenue and preserve equity. In this rationale, distributional and poverty consequences of consumption taxes (VAT) become a major interest in social analysis. Yet, addressing the social impact of VAT reforms, including VAT-trade tax reform, comes to asking the question about the best pro-poor VAT design compatible with a revenue neutral VAT-tariff reform that increases social outcomes.

In general, pioneers of the optimal taxation theory carried out frameworks that emphasize the structure of domestic indirect taxes welfare maximising and revenue increasing. In Ramsey (1927b), consumption taxes should be levied at the same rate on all commodities, if labor supply is fixed. But if this assumption no longer holds, it is better to tax goods on a differentiated[3] rate basis. Diamond (1975) gets a generalized formulation of the Ramsey (1927b)'s law in many persons framework by introducing distributive[4] considerations in the social utility function. The welfare maximising effect is also achieved through a differentiated rate basis, where tax rates should be levied at high rates on goods consumed by agents with less marginal utility of income. Even through these theories provide us with frameworks on the structure of indirect taxation that helps minimize the impact of indirect taxes on social welfare, poverty and inequalities, the well-known administrative challenges faced by developing countries is in favour of uniform VAT rate, and uniform rate also avoid introducing competition between goods (Ebrill, 2001). But uniform VAT rate although economically efficient, would also put aside the envelope of equity (Poh, 2002; Poh, 2003).

By far, there is no consensus in the empirical literature about the best pro-poor VAT design. Ahmad and Stern (1984); and Ahmad and Stern (1991) concluded that a multiple VAT rate or a uniform VAT system with exemptions is more progressive than a uniform rate system based on the case of India. Sahn and Younger (1999) found that a broad based VAT is progressive in eight[5] African countries. Muñoz and Cho (2003) established in the case of Ethiopia that, the uniform VAT rate is progressive but less progressive than the sale taxes it replaced, because the exempted goods under the VAT system is disproportionately consumed by the richest households. Jenkins et al. (2006) show that, the uniform VAT rate system is progressive over all quintiles of households' expenditures based on the Dominican Republic case, whereas Hossain

[3] In Ramsey (1927) this rule is known as "inverse elasticity rule of taxation". To avoid the loss of economic efficiency and the loss of the representative agent's welfare due to plausible substitution between labor supply and leisure, it is better that commodities should be taxed most which have the least elasticity of demand.

[4] Author weighted social utility function by agents' marginal utility of income.

[5] Cote d'Ivoire, Ghana, Guinea, Madagascar, Mauritania, South Africa, Tanzania, Uganda

(2003) carried out that, a revenue-neutral uniform VAT reform is regressive in Bangladesh compare to the pre-reform situation in its impact on income of different households. However, a basic rate of VAT with exemptions for certain commodity groups, has the superior distributional effect.

Taking stock of the above discussions, this paper aims to fit into the debate, by analyzing the equity impacts and poverty implications of VAT based tax-tariff reform for the case of Togo. It will contribute with a relatively advanced methodology to the tax incidence literature by linking a macro computable general equilibrium (CGE) model, to a microsimulation framework, allowing to deal with general equilibrium effects of tax changes at the macro level, together with heterogeneities in the distributional effects of these tax policy changes at the household level (sequential top-down approach). As said, the induced price changes due to the reform, as well as income effects at the macro level, are used as connectors, to conduct distributive analyses after the reform, on household survey data.

The rest of this paper is organized as follows: Section 2 provides summaries of the literature review on the social incidence of VAT in developing countries, while section 3 emphasizes the economic situation of Togo and its VAT and trade tax design. In section 4, we present our data, followed by section 5 that deals with the model. Our simulations consistent with VAT based tax-tariff reform (VAT-trade tax reform) are carried out in section 6. Then we analyze their macro and micro results in section 7. Finally, section 8 is about some sensitivity analyses.

4.2 Social incidence of VAT in the literature

.

Studies that address tax incidence analyses use various techniques. Some use simple macro models (see for example Alavuotunki et al. (2019); Martinez-Vazquez et al. (2012)) that address inequality effect of VAT introduction in a subset of country and found out that, inequality has increased due to VAT introduction, or that VAT has a negative effect on income distribution. Nonetheless, studies based on macro-level analysis, miss to capture important facets of the phenomenon, allowable by micro-data. They couldn't exploit heterogeneities in households composition for example, or exploit the richest information in the structure of their income and expenditure to properly deal with social analysis. So, they are incomplete and misleading. Therefore, most of the literature that aimed at assessing the regressivity of VAT or VAT incidence to some extent, comes back to survey data that are more suitable to rigorously gauge

social incidence parameters. While referring to these types of data, tools used are wide and encompass microsimulation analyses, computable general equilibrium model analyses, or linked macro-micro computable equilibrium models, to better assess effects of tax policy changes on social outcomes.

Microsimulation models enable researchers to simulate the effects of a policy on a sample of agents at the individual level. They offer the possibility to account for observed heterogeneities in socio-economic parameters, where a simulated policy may consist of evaluating the consequences of a change in the economic environment induced by a policy reform on a vector of indicators of individuals in a sample of observations(Bourguignon & Spadaro, 2006). Within this framework, Hossain (2003) investigated the distributional implication of introducing VAT in Bangladesh and established the result that, a revenue-neutral uniform VAT is regressive in its impact on different households. In order to mitigate the adverse impact, the author explores the distributional impact of an alternative policy package consisting of a basic rate of VAT with exemptions for certain commodity groups chosen on the basis of their distributional characteristics. The distributional consequence of the alternative package was found to be superior to those of the uniform VAT. Younger et al. (1999) addressed tax incidence in Madagascar using a nationally representative survey data and found out that the movement away from trade taxes, toward broadly based value added taxes is more equitable and economically efficient. Consumption taxes are progressive and more progressive than import duties (Younger et al., 1999). Essama-Nssah (2007) assessed the social incidence of commodity taxes, based on survey data from Guinea and relies on the price elasticity of the poverty measure, and on the consumption patterns of each commodity. The author shows that many components of food expenditure (particularly cereals, grains and roots) would be good candidates for VAT exemption. Arsić and Altiparmakov (2013) based on microsimulation exercises assessed the equity impact of VAT in the case of Serbia and found that the significant presence of own-source farming production of food in this country presents an important progressivity enhancing effect compared to VAT incidence in developed countries. They conclude their paper by highlighting the fact that, the common belief of inherently inequitable VAT taxation are vastly overstated and poorly understood in the economic reality of less developed countries, where VAT can be described as being mostly mildly progressive. Similar result based on a rich dataset of households' incomes and expenditures for the Dominican Republic's case is also discovered by Jenkins et al. (2006) that brought the powerful result that, the effective VAT rate paid on each item by households is naturally progressive over quintiles of households' expenditures. They explain their results by the fact that commodities on which poor households spend most of their income, are often impractical to tax due most times to exemptions encountered on these types of goods. As a

consequence, the purchase prices of these items will have a lower proportion of VAT content than goods and services consumed by the richest households. Engel et al. (1999) quantified the direct impact of taxes including VAT on income distribution at the household level and found that the after-tax distributional effect of raising VAT from 18% to 25% in Chile is very similar to the pre-reform situation. Muñoz and Cho (2003) provided an assessment of the poverty and social impact of replacing Ethiopia's sales tax with a value-added tax (VAT). Results indicate that this reform has not had a major adverse effect on the poorest 40 percent of the population. The VAT is progressive in its incidence, and the higher revenue brought by VAT can provide additional funds for poverty-reducing spendings. Roy et al. (2010) focused on the poverty implication of introducing VAT in six major India's states in place of sale taxes, and carried out the result that, there are scope of improvements in the design of VAT reform with respect to some items predominantly consumed by the relatively poorer groups. Household data available in India from the National Sample Survey on consumption expenditures for the 55th round was used for this study. Newhouse and Zakharova (2007) assessed a VAT reform that consists in extending VAT base to energy products and professional services, as well as increasing the rate from 10 to 12% in Philippines, and found that the reform was progressive and relatively well-targeted. Salti and Chaaban (2010) examined the impact of a rise in the Value Added Tax (VAT) on poverty and inequality in Lebanon. The simulation results using own and cross-price demand elasticities estimated with an Almost Ideal Demand System show that, the projected VAT rate increases will have a non-negligible impact on poverty and inequality in Lebanon, despite current VAT exemptions. Alderman and Del Ninno (1999) explored the implication of VAT exemption in South Africa on the expenditure of the poor, and established that maize currently exempted from VAT is a best choice for low tax rates from an equity point and the impact on the food consumption of the poor. In contrast, lower tax rates on milk and meat which are currently exempted are not good candidates for assisting the poor.

Nevertheless, these studies based on microsimulation approaches miss to capture the indirect effect of tax policies on prices and cannot fulfill all types of reforms. We need general equilibrium models to fully address tax incidence analyses. They enable researchers to appraise multiple interactions between economy's sectors and to model tax policies with accuracies. Computable general equilibrium models (CGE[6]) are more suitable to address feedback effects of economic policies on a range of indicators, including income and expenditure outlooks of various agents.

Such a CGE model was used by Devarajan and Hossain (1999) to analyse the incidence of taxes in Philippines. They found that indirect taxes are broadly neutral in their incidence because

[6]Computable general equilibrium model afterwards.

of general equilibrium effects. Rutherford et al. (2003) examined the Colombian tax system to evaluate the welfare cost of raising additional government revenue using CGE model. Their model includes several income classes allowing to consider both efficiency and equity considerations. They found that value-added taxes are an equitable source of government revenue both in the short and long run, and economic efficiency is also reached in Colombia using uniform value-added taxes. Emini (2000) built a computable general equilibrium (CGE) model to assess the impact of the imperfect value added tax (VAT) applied in Cameroon. Part of the impact is appreciated through households' welfare indicators. The author found that the VAT implemented in Cameroon is beneficial to the state's revenue, but this success is somewhat mitigated, for the households' welfare worsens.

Beyond all, a major drawback of CGE models is the representative agent condition. For this reason, they cannot address within-group changes following economic reforms. The solution is to link a CGE model with microsimulation framework, to enable dealing both with general equilibrium effect of economic policy changes, together with heterogeneities within the microsimulation analysis. They are called macro-micro computable general equilibrium. Within macro-micro CGE models, we have two approaches: integrated multi-households' approach in a CGE model, or sequential approaches, that distinguish a macro module separate from a micro module but tend to reconcile them. Sequential approaches can be "top-down", "bottom-up", "top-down-bottom-up". In the top-down approach, linking variables can be prices, wages or other linking variables, obtained from the CGE model (Chen & Ravallion, 2004). In the bottom-up approach, survey data are used to calibrate parameters for the CGE model (Cogneau, Robilliard, et al., 2007). Finally, the top-down-bottom-up approach links in two ways the macro model and the micro model until they converge (Bourguignon & Savard, 2008). Building on a sequential top-down approach, Boccanfuso, De Quatrebarbes, and Savard (2011) assessed the best pro-poor VAT design in Niger and found that, broadening the tax base while maintaining high VAT rate will lead to an important increase in poverty. Nonetheless, lowering the rate or maintaining exemptions on agricultural goods have at least superior impact on poverty.

4.3 Economic situation of Togo and its VAT and trade tax design

.

Togo is an African country that belongs to the West African Economic and Monetary Union (WAEMU) community. According to its human development index (0.48), country is ranked

162nd. Its poverty indicators reveal that in 2015, poverty incidence is at 55.1%, and the extreme poverty ratio 28.7% (Institute-Statistics, 2015). Like many other developing countries, the country undertakes during the 2000s, its tax transition reform, that consists in offsetting reduced revenue from international trade liberalization through increased revenue from domestic taxation. Under the decision 10/2006/CM/WAEMU, the country takes precedence over the tax transition agenda, by reinforcing domestic revenue mobilization.

Concerning trade taxes, country's tariff lines basically follow the ones of WAEMU that consist in implementing a common external tariff of four rates: 0% on basic products, 5% on equipment and materials, 10% on inputs and 20% on final consumption goods. Export taxes have almost disappeared in the trade policies of the country, and the effective rate borne by agricultural goods is 0.3% and 0.5% for manufactured goods. The average weighted tariff rate decreases from 14.99% in 1999 to 9.73% in 2015 that corresponds to a revenue loss of about 2 percentage points of trade tax to GDP or 16.5 percentage points of trade tax to total tax revenue.

VAT was introduced in 1995. In order to increase revenue contribution from VAT, the VAT system was standardized to a uniform VAT rate of 18% following the WAEMU directives 02/98/CM/UEMOA, and 02/2009/CM/UEMOA. Reduced VAT rates that were applied to a list of products are no longer in effect[7]. Exports are zero-rated. But some imperfections remain in the VAT system. Agricultural goods as well as medical care, medical services supplied by hospitals, clinics and other similar establishments are exempted from VAT charge[8]. Even imperfectly implemented, VAT constitutes by far, the major source of government revenue accounting for 9% of country's GDP, 42% of total tax revenue and by near 60% of domestic tax revenue in 2015. But a question still remains: does the VAT revenue collection in the VAT based tax transition agenda of this country reconcilable with poverty and inequality at this country level?

4.4 Data.

This study exploits two types of data. The macro model uses data originating from the 2015 social accounting matrix of the country (SAM[9] 2015), and the micro model is based on the "Unified Well Being" survey data conducted the same year at the country level (QUIBB 2015) .

[7]The decision 02/2009/CM/UEMOA allows countries to implement a reduced VAT rate between 5% to 10%.

[8]This list is not exhaustive. Exemptions also cover teaching activities carried out by educational establishments, universities, and professional establishments.

[9]Social accounting matrix

4.4.1 The SAM data

.

The original social accounting matrix comprises 40 branches of activity, each with specific goods that we aggregate to distinguish 4 sectors of production : agricultural sector, industry sector, private services, and public services (table 4.1).

Table 4.1: Sectors of production

	Activities
Agriculture	subsistence farming; breeding and hunting; forestry and forest exploitation; fishing; livestock.
Industry	phosphate extraction; other mining activities; slaughtering; meat processing; fish conservation; manufacture of fatty substances; tobacco products; beverage manufacturing; animal feed manufacturing; manufacture of other food products; cotton gin; manufacture of other textile articles; woodcraft; manufacture of paper and cardboard; manufacture of machines and various materials; manufacture of paper and cardboard; printing and reproduction; chemical manufacturing; manufacture of building materials; manufacture of metallurgical products; manufacture of machines and various materials; other manufacturing and recovery activities; electricity; production of water and gas; construction.
Private services	trade; repairs; catering and accommodation; road transport; air transport; production of auxiliary transport services; post and telecommunication; real estate activities; financial activities; services to companies.
Public services	Public administration; education; health; social protection; other collective activities.

Source: Author with SAM data

We can also distinguish four categories of agents (households, firms, government, and the rest of the world), and two kinds of production factors (labor and capital). Households in the SAM are categorized in two main parts: farmers and non-farmers. The agricultural sector participates for 28.3% to the creation of the economy's total value-added. Its contribution to total production is 15.2%. Production in the agricultural sector is made of 83,5% of added value and 16.48% of intermediate inputs. Agricultural activities are granted subsidies in the initial situation. Sector's production uses 42.3% of labor and 41.1% of capital. Agricultural goods are produced locally (94.3% of total production), imported (5.2% of composite demand) 94.8% of domestic demand, and exported (5.7% of total production).

The industry sector commits to 22% of total production and 10.6% of value-added. Value added in the industry sector represents 21.7% of its total production. The sector makes use of intermediate inputs more than the use of value-added (77.1% versus 21.7%). This drives the little use of workers in the sector as compare to the agricultural sector (10.8% versus 42.3%). But this sector exports more goods than the agricultural sector (58.8% versus 5.7%). Its imports account for 82.4% of the economy's total imports.

For services, private services stand for 41.4% of the total economy's value-added, and 49.9% of total production. This sector also makes more use of intermediate inputs than value-added (61.8% versus 37.1%). Private services are mostly imported than exported. In addition to private services, public services sector contributes to 19.5% of the economy's total value-added, 12.8% of total production.

Regarding public finance, the major source of government revenue is concentrated on indirect taxes, especially VAT (32.2% of government revenue; 50.3% of total tax revenue) and custom duties (15.2% of government revenue; 23.7% of total tax revenue). VAT is almost levied on manufactured goods (74.3%) and private services (22.2%). The contribution from agricultural goods and public services is quietly limited (0.86% and 2.4% respectively). With reference to custom duties, they are also essentially borne by industrial goods (97.2%) and meagerly by agricultural goods (2.7%). While export taxes are mostly levied on manufactured and agricultural goods, their contributions to total tax revenue are negligible (0.4%).

Table 4.2 provides effective rates borne by these goods calculated from the SAM [10]

Table 4.2: Effective tax rates

	Custom duties	Export taxes	VAT
Agriculture	9.6	0.3	1.3
Industry	11.4	0.5	16.5
Private services	0.2	-	10.2
Public services	-	-	7.8

Source: Author with SAM data

This confirms the fact that industrial goods are the ones mostly covered by indirect taxation in this country.

[10] Except VAT effective rate that was calibrated differently.

4.4.2 The QUIBB data

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In addition to the SAM data, this study capitalizes on the "Unified Well Being Survey Data" conducted at the country level in 2015 for the microsimulation framework (sequential top-down approach). The survey covers urban and rural areas of the country and consists of a random sample of 2326 households. The database includes households' income, consumption and expenditure indicators and is published by the country's National Statistical Institute. It also comprises basic demographic characteristics such as the educational level of the household head, its age, sex, the branch of activity, the socio-professional status, and its residence place (urban versus rural). Data from the QUIBB were harmonized with data from the SAM to distinguish two types of households: farmers and non-farmers, based on the main activity of the household head.

Table 4.3 and 4.4 provide some descriptive statistics about households' income and expenditure in the survey. These statistics overall show that, farmers earn much less income than do the non-farmers. Non-farmers also spend more than do the farmers. Note that, these patterns of expenditures are carried out in absolute nor relative terms. But one thing more important to note is that, the amount of expenditures in the survey, is well above the one of incomes. This is due to the "under-reporting bias of incomes" in survey data. Thus, this study will focus more on expenditures data in place of incomes, to address distributional and poverty analyses. This problem of under-reporting bias of incomes in survey data is largely pointed out by several studies (J. C. Moore & Welniak, 2000; Hurst et al., 2014; Meyer et al., 2009; Bound et al., 2001; Cruces et al., 2013).

Table 4.3: Descriptive statistics : incomes

	Obs	Mean	Std.Dev	e(Min)	e(Max)
Farmers	538	362388.1	689232.4	1000	1.04e+07
Non-farmers	1304	425975	1022797	1000	1.50e+07

Table 4.4: Descriptive statistics : expenditures

	Obs	Mean	Std. Dev.	e(Min)	e(Max)
Farmers	586	919349.4	782197.9	13440	5945940
Non-farmers	1740	1375913	1213804	23800	1.41e+07

Source: Author with QUIBB data

4.5 The model

4.5.1 Macro-model

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This study builds on the small open country general equilibrium model of (Decaluwé, Martens, & Savard, 2001). The model encompasses a system of six blocks: production, incomes and savings, the block of expenditures, international trade, prices and equilibriums.

4.5.1.1 The production block

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Production in production branches, derives from a production technology nested in two steps: at the higher step, production is obtained following a Leontief connection between value-added and total intermediate consumption. The Leontief formula at this step is based on the fact that, we both need value-added and intermediate consumption to produce goods. They are complements. At the lower step, value-added is made of labor and capital. We suppose that labor and capital are imperfect substitutes and we model this through a CES[11] production technology. Total intermediate input consumption results from a combination in a fixed proportion (Leontief formula) of intermediate demand of products through the technical coefficient matrix. The producer's problem consists in maximising total production with respect to production costs. We then derive the relative demand of factors according to their relative prices.

In the model, labor is adaptable across sectors but capital is specific to each sector. This means, there exist unique labor remuneration that corresponds to the economy's equilibrium global wage. But it exists as many capital remunerations as production sectors.

[11] Constant elasticity of substitution.

4.5.1.2 The block of incomes and savings

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The model distinguishes incomes and savings of households, firms, government and the rest of the world.

4.5.1.2.1 Households' incomes and savings .

Households derive their incomes from the remuneration of labor and capital, dividends paid by firms, transfers from the rest of agents (government, rest of the world), as well as incomes from self-employment. Transfers are exogenous. Their disposable income is designed as the difference between gross income minus direct taxes (personal income taxes) and transfers they paid to other agents. Their saving is modelled as a residual, which implies the difference between their disposable income and consumption expenditures they made. The level of direct taxes is endogenous, calculated through the effective income tax rates calibrated with the SAM data. These rates are supposed to be exogenous.

4.5.1.2.2 Government revenue and saving .

Government derives its revenue from various sources involving direct and indirect taxes, part of the economy's total capital remuneration [12], and exogenous transfers from the rest of agents (firms, households, and the rest of the world). Direct taxes consist of taxes levied on incomes of individuals and firms. Part of direct taxes also includes taxes on production in the production branches. Indirect taxes levied on goods and services, cover value added taxes, import duties, as well as export taxes. These taxes are endogenous and connected to their tax bases through exogenous effective tax rates computed from the SAM, except the effective tax rate of VAT.

The modelling of VAT revenue receives particular attention to take into account its imperfection in developing countries. We distinguish two kinds of taxpayers (producers): liable and non-liable. Liable producers face two types of dilemmas: the non-refunded VAT from tax authorities and VAT finally borne on their intermediate consumption due to VAT exemptions on final goods. Non-liable producers also bear VAT on their intermediate consumption since they cannot charge VAT on final goods. Thus, VAT revenue collected by the government is the total of VAT collected on final consumption of non-exempted goods and services marketed by liable producers, plus VAT they indirectly borne due to non-refunded VAT and exemptions, and VAT borne on intermediate consumption by non-liable producers. This distinction (liable and non-liable) is reliable due to the fact that, in these countries, we often encounter sizeable part of

[12] This comes from the usage of public equipment and materials as production factors.

informality alongside with the formal sector. The effective VAT rate is then, the result of this form of modelling that takes into account VAT imperfections in developing countries including Togo. The proportion of liable and non-liable producers (formal versus informal producers) as well as the proportion of non-refunded VAT and exempted goods, are considered as parameters in the model but can be simulated.

Lastly, government saving is the difference between government revenue and transfers it made in direction of firms, households, and the rest of the world, minus government spending on final consumption goods. While government total spending is exogenous, government spendings on consumption goods are endogenous and related to total spending in a fixed proportion.

4.5.1.2.3 Firms' incomes and savings .

Firms perceive the rest of the economy's total capital compensation that was not committed to remunerate households and government. They also derive incomes from exogenous transfers made by other agents (households, government, the rest of the world). Their savings consist of their gross incomes net of income taxes (corporate income taxes), minus dividends they paid to households, and transfers to government and the rest of the world.

4.5.1.2.4 Revenue and saving of the rest of the world .

The revenue of the rest of the world consists of the country's imports in foreign currency and transfers received from domestic agents also in foreign currency. Their saving is obtained by subtracting country's exports and transfers the rest of the world made in direction of domestic agents (valuated in foreign currency). Note that, their saving is nothing else than the opposite of country's current account balance.

4.5.1.3 The block of expenditures

.

Expenditures in goods and services in the economy are made up of three types of expenditures: final consumption expenditures (households, government), intermediate consumption expenditures in production branches, and investment expenditures on goods and services. Intermediate consumption expenditures in production branches are already described in the production block through a Leontief formula of sectors' total production (fixed proportion). Households final consumption expenditures is a LES[13] function, derived from the maximization of a Stone

[13]Linear expenditure system of demand.

Geary utility function under budget constraint. Overall, this system of demand (LES) supposes that, households' consumptions depend on an endogenous consumption budget [14], a marginal propensity to consume goods, an incompressible part (not related to income) and good prices. Government final consumption expenditures on goods and services are related to exogenous total government spending in a fixed proportion and depend also on good prices. The same pattern is used in modelling investment expenditures in goods and services. They are related to the country's total investment through a fixed proportion and depending on good prices. These proportions were calibrated through the SAM data. Note that, country's total investment is drained by its total saving which is obtained by summing agents' total saving.

4.5.1.4 The block of international trade

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Two hypotheses govern the modelling of foreign trade: the "small open country assumption" and the Armington (1969) hypothesis. The first implies that a small country is a price taker in international trade: its economy is not large enough to influence world prices of imported and exported goods. These prices are determined exogenously. For the Armington (1969) hypothesis, it stipulates that a good produced in a country and the same good produced abroad are imperfectly substitutable. To model Armington (1969)'s hypothesis, demand of goods in domestic market is a composite demand that is made of local products and their imported substitutes. Consumers tend to maximize the Armington (1969) function under their budget constraint that leads to choose the relative share of domestic demand and imported goods according to their relative prices and the elasticity of substitution between domestic and imported goods (CES based elasticity of substitution function). Note that, the price of imported goods only includes tariffs nor VAT. VAT is applied on the composite price of goods.

Symmetrically, the repartition of total production between local and external market is performed through a constant elasticity of transformation (CET) function. This function captures the ease with which the producer switches its production between domestic market and exports. Producers choose the relative share of production marketable on domestic and export retail sources, taking into account the relative price of domestic supply and exports, as well as the ease to relocate their production on these two markets.

[14] Total consumption budget is related to household's disposable income through average propensity to consume goods.

4.5.1.5 The block of prices

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The price system is made of supply side prices, and prices around demand. A system of tax ensures the connection between the two. The producer price reflects the "per-unit" cost of production which is the weighted average between the value-added price and the intermediate consumption price, reduced of any subsidies. The value-added price is made of per-unit labor and capital remuneration costs, while intermediate consumption price reflects the per-unit cost of intermediate goods demand. Normally, VAT would be neutral vis-a-vis of production costs. But due to imperfections in the VAT system (non-refunded VAT, exemptions), VAT finally enters the per-unit cost of production through intermediate consumption price of goods. According to distinctions made in previous sections, the liable producer may bear VAT charge on its intermediate consumption through non-refunded VAT and exemptions of final goods. Non-liable producers may also support VAT on their intermediate consumption since they cannot charge VAT.

Once the producer price is determined, the price of local supply of goods is obtained as the difference between total producer's price and export price, taking into account the relative part of domestic supply and exports in total production. Export prices are valuated at international prices, and the small open country assumption implies that, if the country wants to impose a tax on exports, this tax comes to reduce the price of exportable goods to maintain the international price constant. In the presence of tax on production, this tax would rather enter the domestic demand price of goods.

Consumers, for their part, ask for a composite basket of goods. The composite basket is made of domestic demand and imports. The composite price is obtained as a weighted average of domestic demand prices and import prices. Import prices take into account tariff rates. Lastly, final consumption price of goods includes VAT and is obtained by applying VAT on the composite price of goods.

4.5.1.6 Equilibriums and model closure

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A certain number of equilibriums must be satisfied. The goods and services market equilibrium is obtained by imposing perfect equality between total domestic absorption of goods and its components. The walras law was imposed. If equilibrium is reached on a subsequent number of markets, then equilibrium must be reached even on the last market.

Labor market equilibrium is obtained by imposing the absolute equality between economy's total

labor supply and the sum of sectorial labor demands. In the capital market, the equilibrium is that, in each sector, capital supply corresponds to its demand. These equilibriums are obtained through price adjustments.

The model closure is that, economy's total saving serves to finance its total investment. A number of additional assumptions are made. Public deficit and current external account balance are endogenous. These mean that government can carry out external debt to finance investments. The nominal exchange rate is exogenous and is considered as numeraire.

4.5.2 The micro-model

.

As emphasized in previous sections, this paper uses a "sequential top-down approach" to address distributional and poverty implications of VAT based tax-tariff reform. As said, the induced price changes at the macro-level due to the reform, are used to compute new vectors of households' incomes and expenditures at the micro-level. We both carry income (expenditure) and price effects simulated at the macro level, to household level, to assess poverty and inequality after the reform. We rely on the GINI index to measure inequality Gini (1912); Gini (1921); Jasso (1979) , and Foster et al. (1984) decomposable poverty index to address poverty.

The GINI index on a random sample consisting of income values indexed in non-decreasing order is based on the formula:

$$GINI = 1 - \frac{2}{n-1} * [n - \frac{\sum_{i=1}^{n} r_i y_i}{\sum_{i=1}^{n} y_i}] \tag{4.1}$$

where n is the population size;

r_i is the individual's rank when incomes are indexed in non-decreasing order;

y_i is individual's income.

For the Foster et al. (1984) poverty index, we use the formula:

$$FGT(\alpha) = \frac{1}{n} * \sum_{i=1}^{q} (\frac{z - y_i}{z})^{\alpha} \tag{4.2}$$

where n is the population size;

z is the poverty line;

q is the number of individuals under the poverty line;

y_i is individual's income.

and α the individual's aversion to poverty.

α can take values between 0 and 2. If α takes the value 0 (FGT0); we have the poverty incidence ratio or headcount ratio. If it takes the value 1 (FGT1), we obtain the poverty gap ratio, and if α is close to 2 (FGT2), we have the extreme poverty ratio or the distance in poverty.

4.6 Simulations

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Our first simulation consistent with VAT based tax-tariff reform, or VAT trade-tax reform (simulation 1) consists in offsetting trade tax revenue losses through VAT increases. We simulate a point decrease in trade taxes (both tariff rates and export tax rates) concomitantly with a point increase in VAT revenue (VAT effective rates). Note that, by its nature, the model predicts VAT effective rates for each commodity. So, we are concerned in this simulation with differentiated VAT rates (multiple rates). In other words, a cut in trade tax rates is compensated through a point for point increase in VAT revenue (VAT effective rates). This is an alternative to address multiple VAT rate design as a tax-tariff reform device.

In simulation 2, we maintain the same framework of multiple VAT rates, but we also exempt agricultural goods from VAT coverage. In this simulation, challenges that could arise from VAT refunds, are kept constant to the initial situation level. We carry out this simulation to address an option of VAT design pro-poor oriented and look at its macro effects to further assess inequality and poverty distributions at the micro-level after the reform.

Simulation 3 lays the basis for uniform VAT rate as a tax-tariff reform tool. Now, we compensate a point decrease in trade tax revenue with a point increase in VAT revenue, through uniform VAT rate of 18%.[15] To complement our analysis on the uniform VAT rate framework, and in order to address pro-poor VAT design compatible with revenue, we also calibrate the uniform VAT rate that just maintains government revenue unchanged, following the decrease in trade taxes. This was done by exogenizing the VAT revenue to the level that compensates for the decrease in government revenue, and by endogenizing the VAT rate (simulation 4). Then we undertake a simulation based on this rate and provide its macro and micro results (simulation 4).

In addition to simulation 4, simulation 5 maintains the uniform VAT rate system of simulation 4 but authorizes a reduced rate of 5% on agricultural goods.

Finally, the latest simulation (simulation 6) exempts agricultural goods from VAT coverage under the uniform VAT rate system of simulation 4. This means, agricultural goods are fully exempted, but the rest of commodities bear uniform VAT rate of simulation 4. We also kept constant VAT refund challenges to the initial situation level in both simulation 5 and 6.

In all the above simulations, we are interested in the induced price changes as well as income(expenditure) effects of the reform at the macro level, to conduct microsimulation exercises at the household level based on the poverty and inequality indicators previously outlined.

[15] This is the uniform VAT rate adopted by the country.

4.7 Results

4.7.1 Macro-results

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-Implications of compensating a point decrease in trade tax revenue through a point increase in VAT revenue (simulation 1).

Table 4.13 in the appendix provides results of VAT based tax transition concerns consistent with simulation 1. A point decrease in trade tax is offset through a point increase in VAT. This policy orientation (multiple VAT rates) was sufficient to compensate for government revenue, and even slightly increases it by +1.9%. Industrial goods and services are the ones that bring more VAT revenue (+14.4% for industry; +13.1% for private services; +10.8% for public services). This was sufficient to offset decreased revenue from trade taxes (-12.9% of custom duties and -12.3% of export taxes in the industry sector, -11.8% of custom duties for private services). In the agricultural sector, the increased in VAT revenue (+10.7%) was insufficient[16] to offset the decline observed in the sector's trade tax revenue(-16.7% of custom duties; -1.3% on export taxes).

Note that, following the trade liberalization framework, prices of imported goods decreased by (-0.8%; -1%; -0.02%) respectively for agricultural goods, industrial goods and private services, while prices of exported goods increased by (+0.02% and +0.05%) for agricultural and industrial goods, as direct effects. The decrease observed in import prices of agricultural and industrial goods, was enough to induce a decrease in the composite price[17] of these goods (-7.1% and -0.9%), while the composite price of services increased by 12.2% due to increases in their domestic prices (+13.5%). Lastly, only final consumption prices of agricultural goods decreased (-7%) while responding to cuts in trade taxes with increases in VAT. This is simply due to the fact that, agricultural goods are practically exempted from VAT charge in the initial situation. The revenue replacement strategy by VAT however increases final consumption prices of industrial goods, private services, and public services (+1.6% and +14.1%; +0.5%).

Turning back to the government revenue effect of the reform, we noticed that government revenue typically increased by (+1.9%). Under the assumption of fixed government total spending, the expansion in government revenue leads to an increase in its total saving (+19.7%). But economy's total investment decreases by (-1.4%) due to a fall in households' savings (-7.4% for non-farmers, -5.6% for farmers) and in firms' savings (-72%). The fall observed in households and firms' savings is an indirect effect, that need detailed explanations based on labor and capi-

[16] Agricultural goods are mostly exempted in the initial situation.

[17] The composite price of goods, is the weighted average of domestic demand price and import price.

tal market outlooks following the reform. Subsequently, the cut in total investment was enough to induce a fall in manufactured goods' investments (-3%) and in private services' investments (-13%), while investments in agricultural goods increase by (+5.9%) due to the cut in final consumption prices of agricultural goods. These patterns of investments may shape demand behaviours of goods and services.

In the agricultural sector, the absorption of agricultural goods decreases by (-0.6%) even though investments have increased in the sector. This is due to a fall in final consumption of agricultural goods by non-farmers (-0.4%) that was enough to counteract increases in farmers consumption of the same goods (+1.2%) and increases in agricultural goods' investments. While farmers' consumptions in agricultural goods were price-sensitive, it seems like consumption of non-farmers in the same goods were price-inelastic[18]. In the industry sector, the cut in the sector's investments on manufactured goods was enough to induce a decline in domestic absorption of these goods (-3.3%). Nevertheless, in the private services sector, the cut in its investments doesn't cause a fall in the domestic absorption of these goods (+4.3%), due to increases in intermediate demands of the sector (+0.4%). Domestic absorption of public services however decreased by (-1.5%). The rise, however in industrial, public, and private services prices due to VAT, lowers households' consumptions in industrial goods, public and private services (-8.3%; -17.6%; -7.1% respectively for non-farmers and -6.7%; -15.9%; -5.5% respectively for farmers).

To sum, concerning demand, the composite demand of agricultural and manufactured goods, as well as public services decreased following the reform by (-0.6% and -3.3%, -1.5%), while the composite demand of private services increases by (4.3%). The cut in composite demand of agricultural, industrial goods, and public services is driven both by cuts in imports (-7.4%; -3.2%; -2%) and in domestic demand (-0.1%; -3.5%; -1.5%) of these goods. Imports of these goods were price-inelastic following the trade liberalization policy[19]. But imports of private services as well as their domestic demands increase. Private services imports increase (+19.9%) due to the fall in tariff rate of these goods.[20]. Then, the observed demand behaviours would shape production behaviours.

Production of manufactured goods as well as public services decrease by (-3.1%; -1.52%), as a reaction to fall in domestic demand of these goods, while production of private services increases (+1.2%) also due to raises in domestic demand of these goods. In the agricultural sector, total production increased (+0.4%) mostly drained by exports (+9.6%). So, following the reform, production in the agricultural sector and private services increase, while production in the industrial sector and public services decrease. These production behaviours are sufficient to explain

[18]Non- farmers households also have less propensity to consume agricultural goods as compared to farmers.

[19]Imports of these goods were price-inelastic since it is found that the price of imported goods have almost decreased in all goods.

[20]Imports of private services for their part, were price-sensitive.

value-added reactions in all branches. Value-added of agricultural and private services increase, while value-added in the industry and public services decrease. Agricultural and private services sectors attract part of the workforce from the industrial and public services sectors, providing a drop in the economy's labor remuneration (-10%). The fall in value-added of industrial goods and public services also lead to a fall in capital remuneration in these sectors (-16.3%; -13.1%), while the cut in wages in the agricultural and private services sectors lead to a cut in the relative demand of capital as compared to labor, that further decreases capital remuneration prices in these sectors also (-9% and -7.4%). As households' incomes depend on wage remunerations and firms' incomes mostly on capital market remunerations, these help understand the fall in their savings previously encountered. Farmers' incomes fell by (-5%) while non-farmers' incomes by (-6.9%). These fall in households' incomes coupled with raises in good prices, may support the fall in final consumption of households previously encountered. Consumption in all goods fell except consumption in agricultural goods by farmers, that benefits from cuts in agricultural good prices previously justified. Here, the price effect was sufficient to counteract the income effect.

-Implications of compensating a point decrease in trade tax revenue through a point increase in VAT revenue while exempting the agricultural sector (simulation 2).

Simulation 2 produces the ongoing results (table 4.14): government revenue is compensated and increases as well. The increase is nearly the one obtained in simulation 1 (+1.9%). VAT revenue was brought by industrial goods (+14.9%) as well as services (+14.3% for private services and +11.8% for public services). Agricultural goods are fully exempted in this scenario (+0%). We also notice an increase in government saving consistent with exogenous total government spending's hypothesis. There are no major changes in economy's total investment that decreases at nearly rate (-1.4%) as compared to simulation 1, due to decreases previously highlighted in households' savings (-6.5% for non-farmers, -4.9% for farmers) and in firms' savings (-62%). Nonetheless, the decrease in firms' savings was less than in simulation 1 (-62% versus -72%). Investments in agricultural goods increase at nearly rate as for simulation 1 (+5.6%) due to decreases in final consumption prices of agricultural goods. The cut observed in investment of manufactured goods was less than in simulation 1's scenario (-2.6% versus -3%), and investment in services always keeps its trend (-13.5%). Next, domestic absorption of agricultural goods increases this time due to a combined increasing effect in the sector's investment with a much higher increase in the consumption of farmers households (+1.4% versus +1.2% in simulation 1). Consumption of non-farmers still decreases but at a much lower rate (-0.02% versus -0.4% in simulation 1). Domestic absorption of private services still increases as in simulation 1 (+3.4%).

In this simulation, industry sector and public services continue to suffer from the reform. The absorption of industrial goods still decreases by (-2.6%) less than in simulation 1 (-3.3%). For public services, their domestic absorption decreases by (-1.8%). The increases in absorption of agricultural goods and private services are drained by increases in their domestic demand (+0.5% and +2%) respectively. Domestic demand for industrial goods decreases (-1.7%) but less than in simulation 1 (-3.5%). Finally, production increases in both the agricultural sector and private services sector. Production in agricultural sector increases more than in simulation 1 (1% versus 0.4%), and production in private services by (+0.3%). Production still decreases in the industry sector (-0.8% versus -3.1% in simulation 1) and in public services, due to decreases in domestic demand of these goods. Hence, value-added increases in agricultural sector and private services sector. They continue to attract workers from the industry and public services sector, and the decrease in wages is much lower (-8% versus -10%). As labor becomes much higher in value-added than capital, this puts capital remunerations much lower in all sectors (-6% in agricultural sector, -10% in the industry sector, -8% in private services and -12.6% in public services). This helps understand cuts in households' incomes and in firms' incomes previously outlined. The cut observed in income combined with raises in prices due to VAT (+1.1% in industry, +13.9% in private services, +0.9% in public services), consistently decrease households' final consumption in industrial goods, private and public services (-7.1%, -16.8%, -6.7% for non-farmers); (-5.6%, -15.2%, -5.2% for farmers). These cuts were less pronounced than in simulation 1. Final consumption price of agricultural goods decreases following the reform and explains the increase in farmers consumption of agricultural goods, while the one of non-farmers was price insensitive.

-Implications of compensating a point decrease in trade tax revenue through a point increase in VAT revenue with uniform VAT rate of 18% (simulation 3).

We now start from the standard VAT framework implemented in the country (VAT rate 18%), and we respond to a cut in trade taxes with an increase in VAT revenue. Simulation 3 (table 4.15) provides the following results: government revenue is fully compensated and even increases more (+12.5%). Such a scenario puts all sectors to VAT contribution at the same 18% level. VAT revenue was brought by all sectors and was much enough to compensate decreases observed in trade taxes. For example, while custom duties decreased by (-13.4%) and export taxes by (-11.8%) in the industry sector, VAT revenue quietly increased by (22.7%) in the sector. At the same time, the increase was by (+81%) in private services sector for an analogously decrease of custom duties of (-19.1%). The contribution requested from the agricultural sector in this scenario, was very huge (+1250%), since this sector was mostly exempted in the initial

situation (VAT effective rate of 1.3%). So, government revenue increases a lot. This increase causes a huge increase in government saving (+131%), that resulted in an increase of economy's total investment this time (+4.5%). The increase in total investment ended with an increase in agricultural and industry sectors good investments (+13.1% in agricultural sector; +1.6% in industry sector) where total investment increased much faster than rises in these sectors good prices. Prices of major goods increase (+2.8% in industry, +23.8% in private services, +4.7% in public services), but prices of private services increase much faster (+23.8%) than the increase in total investment(+4.5%), that conversely leads to a decrease in private services goods' investments (-15.5%).

Concerning demand, domestic absorption of agricultural goods decreases this time (-3.2%) as well as domestic absorption of industrial goods (-3.7%). This is due to the fact that, the increase in investment in these goods was less enough to counteract the fall in final consumption of all households and in all goods, resulting from major rises in good prices. Final consumption of industrial goods decreases by -14.2% for non-farmers, -11.4% for farmers. This drop is -27.6% for non-farmers, -24.7% for farmers in private services, and -15.2%, -12.3% in public services respectively for these two types of households. These cuts in consumption, are more pronounced than in simulation 1 and 2, and even consumption of farmers decreases for the first time in agricultural goods following this simulation (-1.8%). Consumption of non-farmers also decreases in agricultural goods much faster than in previous simulations.

The cut in domestic absorption of agricultural and industry sectors' goods is drained by cuts in domestic demand of these goods (-2.3%; -3.5%), but also cuts in imports of these goods following the reform (-17.7%; -3.8%). Only absorption of private services increases (+7.5%), due to raises in total intermediate demand of these goods (+2.1%), while domestic absorption of public services decreased by (-6.1%).

Production in agricultural, industry, and public services sectors decrease (-1%; -3%; -6%), due to falls in demand of these goods, while production of private services increases (+4.1%). While the fall in agricultural goods production comes from falls in domestic supply of these goods (-2.3%), falls in production of industrial goods are driven both by falls in their domestic supply (-3.5%) and falls in exports of these goods (-2.1%[21]). Further, the increase observed in total production of private services results from increases in domestic supply of these goods rather than in exports (+6% versus -11.2%). The cut in agricultural, industry and public services production can also be explained by fall in producers' prices, itself driven by fall in the value-added price of these sectors (-18.4%; -20%, -20.3%). These sectors, in order to cope with decreased value-added price, are recruiting fewer and fewer workers and less capital, which lowered wages (-17.3%) very huge than in simulation 1 and 2, and capital remunerations (-19.6% ,-22.6%, -

[21]Exports of manufactured goods were not sensitive to cut in export tax rates.

28.2%) also very importantly. Farmers and non-farmers' incomes decrease and much faster than in simulation 1 and 2 (-8.5%; -11.9%).

-Unique VAT rate of 15% simulation results (simulation 4).

We now carried out the coming simulation. Regardless of the decrease in government revenue following the trade liberalization policy, we just make sure that, the fall in government revenue is exactly compensated by VAT revenue with no extensive possibility for government to reach additional revenue. We ensure that government revenue is kept unchanged following the global reform, by calibrating the uniform rate of VAT that preserves government revenue. As said in the above sections, we exogenize VAT revenue to the level that just compensates for government revenue losses, and endogenize VAT rate. The underlined uniform VAT rate found is 15%. We conduct a simulation based on this rate structure. It produces the following results (table 4.16): government revenue remains unchanged (+0%). In the context where government saving is not affected, economy's total investment decreases by (-7.5%) as a result of cuts in households and firms' savings.

Simulation 4 also leads to decreases in final consumption price of agricultural and industry goods as direct effects (-4.9%; -2.7%) but increases final consumption price of services (+14.9% for private services; +2.3% for public services). For the industry sector's price, this is not surprising since industrial goods bear high effective VAT rate at the initial situation as compare to this simulation scenario, that could explain the decrease this time in industry final consumption prices. But the effective rate of simulation 4 is above the initial situation rate of services that leads to increases in their prices. The decrease in final consumption price of agricultural goods is explained by a more decrease in their composite price due to cut in tariff rates, that was much enough than the increase in VAT rate from a low initial situation level(+1.3%).

The decrease in investment was sufficient to induce a decrease in domestic absorption of agricultural and industrial goods (-1.9%; -2%) also shaped by a combined decrease in domestic demand of these goods and in imports[22]. Note that, cuts in domestic demand of agricultural and industrial goods were however, less than cuts observed in their demand from simulation 3 (-1.3% versus -2.3%; -0.6% versus -3.5%). In the private services sector, we notice an increase in domestic demand of these goods (+3.3%). Indeed, something more important to note is that even if production decreases in agricultural sector, it increases the first time in industry, and also in private services (+0.6%; +1.7%). The increase in production in industry sector is drained by increases in exports (+2.4%) of these goods nor in domestic supply. Exports of these goods were sensitive to cuts in exports tax rates. Conversely, the increase in total production of private services is more guided by increases in domestic supply of these goods (+3.3%) nor

[22]Imports of these goods were not sensitive to cuts in tariff rates

in exports. In the agricultural sector, the fall observed in their production is driven by fall in domestic supply of these goods.
Even though consumption prices of agricultural and industrial goods decreased as previously highlighted, final consumption of households decreased in both the two goods, because the income effect of the reform was more important than the price effect. Indeed, households' incomes fell by (-5.9% for farmers and -8.3% for non-farmers), always explained by falls in wages and capital remunerations. The decrease in households' incomes was however, less important than in simulation 3 (-5.9% versus -8.5%; and -8.3% versus -11.9%).

By far, simulation 4 is based on a strong hypothesis that, government observes the decline in trade taxes before setting up the unique VAT rate that offsets the observed revenue drop. Government may not have this capability to adapt. So, the best to do, is to start from this reference low rate situation, and to compensate any future drop in trade tax by an equal increase (point for point) in VAT revenue.

-Unique VAT rate of 15% with reduced rate of 5% on agricultural goods (simulation 5).

In simulation 5, we maintain the uniform VAT rate of 15% of simulation 4 but authorize a reduced rate of 5% on agricultural goods. In this simulation, government reacts to a point decrease in trade tax with a point increase in VAT revenue. Results (table 4.17) are compatible with a revenue-neutral VAT-trade tax reform, where a point decrease in trade tax is offset by a point increase in VAT revenue. The price of consumption goods drops as in simulation 4 for agricultural and manufactured goods but increases for services. We observe the same trend for investment as in simulation 4 (decreases) which is due to the fall in households and firms' savings. But production increases in the agricultural sector this time (+0.6%) because of decreased production costs in the sector (-9.7%). Production also increases in private services sector (+2.1%). Only the industry sector is negatively impacted by the reform, but the decrease in their production is lower than in simulation 3 (-0.9 versus -3%). Labor demand increases in agricultural (+1.3%) and services (+4%) sectors and is allowed by a shift of workers from industry to the rest of sectors. In addition, consumption of farmers in agricultural goods increases (+0.7%) because the price effect outweighs the income effect (-8.1% versus -6.5%).

-Maintaining unique VAT rate of 15% while exempting the agricultural sector (simulation 6).

This policy orientation is also compatible with revenue. The same argument is maintained: starting from the rate structure of simulation 4, government reacts to a point decrease in trade

tax with a point increase in VAT. We have nearly results as in simulation 5 (consumption prices decreased in agricultural and industry sector, and farmers' consumption increases more (+1.8%). Yet, one additional important aspect to note is that, production increases in major sectors including in the industry sector this time (+1.7%; +1.4%; +0.9%). Labor demand also increases in all sectors (+3.5%; +3%; +1.8%), and agricultural sector drives more workers than the rest of sector (+3.5%). These results are provided in table 4.18.

4.7.2 Micro-results

.

In this section we aim at providing micro-results of our simulations (distributional and poverty impact of the reforms). As previously outlined, we carry price and income effects of the reform to household level and analyse poverty and inequality distributions. The poverty line used, is the one defined in the survey which is based on expenditure per capita for that year. It is valuated at 344408 local currency per capita and per year in 2015 which is below the poverty line of the world bank (1.90 dollars per day and per capita).

At the initial situation, poverty incidence (FGT0) is at 64.7%, more pronounced among farmers (83.6%) than non-farmers (58.4%). Poverty gap (FGT1) is at 31.2% also wide between farmers (49.6%) than non-farmers (25.1%). The extreme poverty ratio (FGT2) for the population is close to (18.8%), more pronounced between farmers (33.2%) than non-farmers (13.9%). Poverty conditions are therefore linked to the branch of activity of the household head (farmer versus non-farmer).

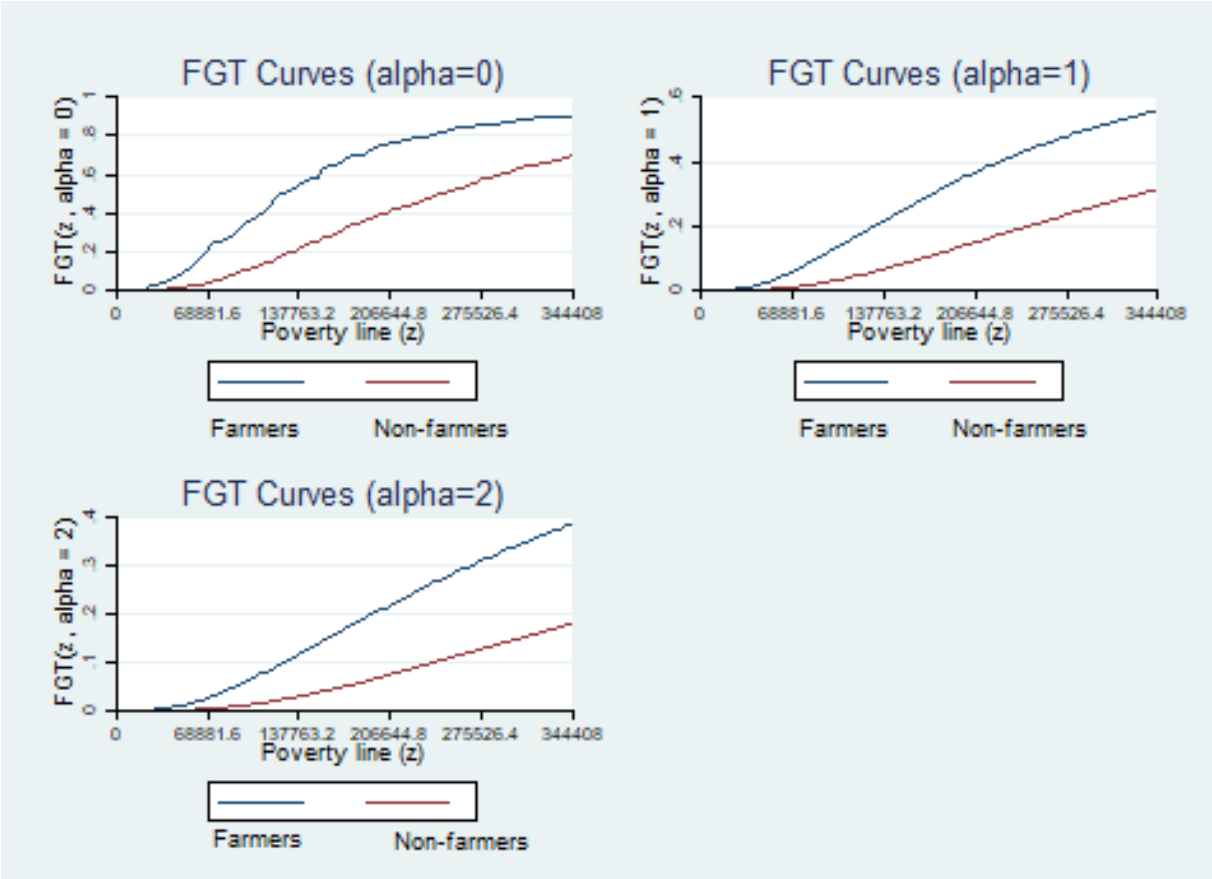
For the inequality measure, the Gini index at the initial situation is 44.6%, more pronounced between non-farmers (42.6%) than between farmers (41.6%).

Table 4.5 provides summaries of the initial situation poverty and inequality measures.

Table 4.5: Basic initial situation's indicators (%).

	Population	Farmers	Non-farmers
GINI	44.6	41.6	42.6
Poverty rate	64.7	83.6	58.4
Poverty gap	31.2	49.6	25.1
Extreme poverty	18.8	33.2	13.9

Source :Author with DASP package in Stata.



Source : Author with DASP package in Stata.

We compute new vectors of expenditures at the household level. Since expenditures in the survey are tax included, we compute expenditures excluding tax by the formula:

$$Expenditure\_ext = \frac{Expenditure\_int}{1+t} \tag{4.3}$$

Where *expenditure_ext* represents expenditure excluding tax, and *expenditure_int*, the one including tax. t is the standard VAT rate at the country level.

We bring the price-induced tax changes from simulations, to individual level to compute new patterns of expenditures tax included based on expenditures excluding tax. Note that, in initial situation, prices were initialized to one. Then, it is easy to take the induced new prices originating from tax policy changes, to calculate new vectors of expenditures. We also make sure to bring expenditure effects of the reforms to individual level. It represents such a way to bring both income and price effects of the reform, to household level after the reform and analyse their social incidence properties.

Table 4.6 provides results of the concerned reforms. Note that, in all simulations, inequality increased after the reform, as well as poverty parameters. A general constatation is that, uniform VAT rate systems brought smallest increase in inequality than multiple rates, but multiple rate systems increased poverty less fast than uniform rate systems. Nonetheless, result obtained from simulation 3 suggests that, single rate system actually implemented in the country (+18%), serves just to smooth inequalities, but consistently increases all dimensions of poverty in the country at a higher level. Thus, a VAT based tax-tariff reform stationed on this rate structure could not address poverty challenges. It only increases government saving with no gainful impact on poverty. Poverty started by falling from a single rate of 15% (simulation 4) as compare to simulation 3.

In addition, simulation 2 and simulation 6 have interesting rival properties. Admittedly, they increase poverty, but contribute to increase poverty at very nearly rates. If we stick to extreme poverty (distance in poverty), they have equal poverty distribution. But simulation 6, has additional property that, it increases less inequality as compared to simulation 2. Further, we can also note that, simulation 6, has better macro outcomes than simulation 2 in macro-analysis (production increases in major sectors, as well as labor demand, which is not the case in simulation 2 where industry and public services sectors continue to suffer from the reform).

Even though, no reform has contributed to reducing poverty and inequality, the best to do, is to adopt low uniform rate of 15% while exempting agricultural sector from VAT. It is consistent with a revenue-neutral VAT-tariff reform, that increases less inequality and spreads less poverty at the country level.

Table 4.6: Changes across simulations: Total population (percentage points)

	Reference	Sim1	Sim2	Sim3	Sim4	Sim5	Sim6
GINI	44.6(+0%)	+0.54***	+0.54***	+0.45***	+0.5***	+0.5***	+0.5***
Poverty rate	64.7(+0%)	+7.95***	+7.44***	+9.89***	+8.38***	+8.25***	+7.47***
Poverty gap	31.2(+0%)	+6.77***	+6.49***	+8.42***	+7.2***	+7***	+6.5***
Extreme poverty	18.8(+0%)	+5.34***	+5.11***	+6.63***	+5.66***	+5.52***	+5.11***

Source :Author with DASP package in Stata.

An intragroup analysis (table 4.7 and 4.8) reveals that, while poverty increases in total population, this masks disparities across households. Poverty rate increases more in the non-farmers' group than in the farmers (8.78 versus 4.45 percentage points increase). The fact that, poverty headcount ratio increases more in non-farmers' group than in farmers is due to a "composition effect in spending". Non-farmers spend more on services items where prices have increased a lot due to VAT raises, than do the farmers whose main spendings are based on agricultural goods.[23] So, one could state that the reform was globally painless for the poor (farmers) than for the rich (non-farmers). Yet, despite the fact that distance in poverty increases in the farmers' group (6.11) than in the non-farmers (4.98), this does not put many agricultural households in poverty as compared to non-farmers. For intragroup inequalities, they are also found to be more pronounced within the non-farmers' group than within the farmers. But, as the reform overall increases poverty and inequality in the two groups, we further document this challenge by providing targeted transfers with revenue brought by simulation 6's reform to households in an additional simulation (simulation 7). Targeted transfers are carried out by the tax-benefit literature, as complementary tools to deal with poverty and unequal income distributions (S. Levine et al., 2009; Decoster et al., 2019).

[23]Farmers spend more on agricultural goods as compared to services, and quietly benefit from exemptions in agricultural products in simulation 6's scenario. We provide in appendix table 4.19 the composition in spendings.

Table 4.7: Changes across simulations: Farmers (percentage points)

	Reference	Sim1	Sim2	Sim3	Sim4	Sim5	Sim6
GINI	41.6(+0%)	+0.62***	+0.62***	+0.63***	+0.61***	+0.61***	+0.61***
Poverty rate	83.6(+0%)	+4.96***	+4.28***	+6.16***	+5.3***	+5.3***	+4.45***
Poverty gap	49.6(+0%)	+6.29***	+6***	+7.39***	+6.55***	+6.39***	+6***
Extreme poverty	33.2(+0%)	+6.33***	+6***	+7.42***	+6.58***	+6.43***	+6.11***

Source : Author with DASP package in Stata.

Table 4.8: Changes across simulations: Non-farmers (percentage points)

	Reference	Sim1	Sim2	Sim3	Sim4	Sim5	Sim6
GINI	42.6(+0%)	+0.65***	+0.65***	+0.66***	+0.64***	+0.65***	+0.64***
Poverty rate	58.4(+0%)	+8.89***	+8.43***	+11***	+9.35***	+9.18***	+8.78***
Poverty gap	25.1(+0%)	+6.84***	+6.54***	+8.67***	+7.32***	+7.13***	+6.74***
Extreme poverty	13.9(+0%)	+5***	+4.83***	+6.41***	+5.41***	+5.27***	+4.98***

Source : Author with DASP package in Stata.

4.8 Sensitivity analyses

4.8.1 Is there any residence place effect, that shapes our results?

We maintain the simulation 6's framework and split households according to their residence place. Poverty and inequality parameters may look differently depending on the residence place of the household head (urban versus rural). For example, while income or expenditure levels would be higher in urban areas than in rural, the share of in-kind expenditures would also be much larger in rural areas than in urban (Muñoz & Cho, 2003). So, it becomes interesting to look at the incidence profile of the reform in rural versus urban areas. Results are given in table 4.9 and 4.10.

We found that, within the group of farmers, poverty and inequality increase more in urban areas than in rural areas. This is an interesting result that can be explained by the following: the main item of expenditure of farmers is agricultural goods, and rural farmers have greater ability to self-consume agricultural goods that escape market considerations, than do the urban ones. This is the plausible explanation to the result we found. But within the non-farmers' group, poverty and inequality are however rural phenomena. This study finds out heterogeneous residence place effects, depending on (1) the household branch of activity, (2) the expenditure patterns within each group of households (composition effect in spending).

Table 4.9: Urban versus rural: simulation 6 (percentage points)

	Urban-farmers	Rural-farmers
GINI	39.7 (+0.6***)	39.5(+0.3***)
Poverty rate	82.3 (+7.4***)	89.4 (+3.4***)
Poverty gap	43.5 (+7.9***)	54.6 (+6.1***)
Extreme poverty	27.2 (+7***)	37.3 (+6.3***)

Source: Author with DASP package in Stata.

Table 4.10: Urban versus rural: simulation 6 (percentage points)

	Urban non-farmers	Rural non-farmers
GINI	41 (+0.5***)	39.7(+0.8***)
Poverty rate	52.4 (+9***)	67.1 (+9.2***)
Poverty gap	20.4 (+6.4***)	35.4 (6.8***)
Extreme poverty	10.6 (+4.3***)	21.7 (+5.2***)

Source : Author with DASP package in Stata.

Note: The first number represents the value of the indicator at the initial situation. The second number is the point increase.

4.8.2 The role of social transfers in mitigating poverty and inequality

.

There is a growing focus in developing countries on the role of social transfers, towards reducing poverty and inequality (S. Levine et al., 2009; Barrientos, 2012; Ferrarini et al., 2016; Devereux et al., 2017). The tax-benefit literature suggests that government raises taxes and spends more in social programs to straighten the inequality curve after taxation (Immervoll et al., 2006; Immervoll et al., 2007; Decoster et al., 2019). Social transfers have a much stronger redistributive impact than taxes (Wang et al., 2012). Effective social transfers reduce poverty and inequality, and these social effects generate social development in many developing countries (Barrientos, 2012). According to Prasad (2008) inequality can be addressed through a combination of social services and taxation. Brady and Bostic (2015) found that, universal social policies would better reduce poverty and inequality than social policies targeted only on the poor, while S. Levine et al. (2009), based on Namibia's case, show that targeted social cash transfers have large effects on poverty reduction and that the effects are particularly positive for the poorest of the poor.

This paper provides additional simulation (simulation 7), in the following rationale : one third of the additional revenue generated by the reform is allocated to non-farmers households, and the two-third to farmers households[24]. Table 4.11 presents results of this policy orientation on poverty and inequality after the reform. We found that, even though poverty and inequality

[24]This repartition is debatable. But the rationale behind, is to provide transfers on universal basis, with differentiation in amounts, quick to deal both with inequality but also poverty at the same time.

still remain, they decreased in total population and within groups. Inequality in the population decreased by 0.2 points, as compared to simulation 6 (0.5 versus 0.3 percentage points), and extreme poverty decreased by 0.41 points (5.11 versus 4.7 percentage points) with reference to the same simulation. Yet, extreme poverty (distance in poverty) decreased more in farmers' group (6.11 versus 4.8 percentage points) than within the non-farmers (4.98 versus 4.80). Remarquably, there is no more difference in extreme poverty over these two groups (4.8 all over). Nonetheless, results of this study consistently support the fact that, we need sound policy instruments to deal with poverty as a matter of concern at this country level. Improving market conditions, that best boost wages and capital compensations in the reform agenda, would certainly contribute to increase more income and deal with poverty, if also guided by redistributive tools such as transfers at this country level.

Table 4.11: Taking into account social transfers: simulation 7 (percentage points)

	Population	Farmers	Non-farmers
GINI	44.6 (+0.3***)	41.6(+0.6***)	42.6(+0.6***)
Poverty rate	64.7 (+7***)	83.6 (+3.2***)	58.4(+8.2***)
Poverty gap	31.2 (+6***)	49.6 (+4.7***)	25.1(+6.4***)
Extreme poverty	18.8(+4.7***)	33.2(+4.8***)	13.9(+4.8***)

Source : Author with DASP package in Stata.

Note: The first number represents the value of the indicator at the initial situation. The second number is the point increase.

4.9 Conclusion

.

This paper addresses the poverty and distributional consequences of VAT-based tax-tariff reform (VAT-trade tax reform) for the case of Togo. It is in light with tax policies that overall recommend a revenue replacement strategy of trade taxes with value-added tax (VAT). We found that, VAT-based tax transition agenda in Togo is globally unfair and poverty increasing. A VAT-tariff reform based on the actual uniform rate of 18% is poverty expanding. A low VAT rate of 15% raises poverty much less than the actual uniform rate, and is also revenue increasing, meaning

consistent with a revenue-neutral VAT-trade tax reform. Exempting agricultural sector from VAT coverage from the 15%'s rate situation, is also consistent with a revenue-neutral reform that has the property to increase less poverty, with superior distributional effect. Nonetheless, the paper found a major interesting result that, according to patterns of spendings, the incidence of poverty is much larger supported by the non-farmers than the farmers, and also that, urban farmers are more affected by the reform than rural farmers. Yet, it also found that, granting transfers to households with revenue brought by the reform proves remarkable poverty-reducing effect, but also helps deal with inequality to some extent.

Appendix 1: CGE: List of equations

A. Production and employment.

i=goods, j=branches, h= households.

1. VA(j)=v(j)*XS(j)

2. CI(j)=io(j)*XS(j)

3. VA(j)= A(j)*$[\beta(j) * KD(j)^{-\rho(j)} + (1 - \beta(j)) * LD(j)^{-\rho(j)}]^{\frac{-1}{\rho(j)}}$

4.$\frac{KD(j)}{LD(j)} = [\frac{W}{R(j)} * \frac{\beta(j)}{1-\beta(j)}]^{\sigma(j)}$

5.$DI(i,j) = aij(i,j) * CI(j)$

6.$DIT(i) = \sum_j DI(i,j)$

B. Incomes and savings.

7.YH(h)=$\lambda^l(h) * \sum_j W * LD(j) + \lambda^k(h) * \sum_j R(j) * KD(j) + DIVE^e(h) + TRH(h) + AUTOE(h) + TGH(h) + TRMH(h) * E$

8.$YDH(h) = YH(h) - TDH(h) - THE(h) - THG(h) - THRM(h) - TVH(h)$

9.$SH(h) = YDH(h) - CTH(h)$

10.$YE = (1 - \sum_h \lambda^k(h) - \lambda^k g) * \sum_j R(j) * KD(j) + TEE + \sum_h THE(h) + TGE + TRME * E$

11.$SE = YE - TDE - \sum_h DIVE^e(h) - TEE - TEG - TERM$

12.$YG = \lambda^k g * \sum_j R(j) * KD(j) + \sum_h TDH(h) + TDE + TDRM * E + \sum_i TI(i) + \sum_i TM(i) + \sum_j TXP(j) + \sum_i TE(i) + TEG + \sum_h THG(h) + TRMG * E$

13.$TDH(h = tyh(h) * YH(h)$

14.$TDE = tye * YE$

15.$TDRM = tyrm * YRM$

16.$TI(i) = tcn(i) * (1 - exon(i)) * [PQ(i) * \sum_h C(i,h) + nass(i) * PQ(i) * DIT(i) + (1 - nass(i)) * exon(i) * PQ(i) * DIT(i) + (1 - nass(i)) * credit(i) * PQ(i) * DIT(i)]$

17.$TM(i) = tmm(i) * PWM(i) * M(i) * E$

18.$TE(i) = tex(i) * PE(i) * EX(i)$

19.$TXP(j) = tx(j) * PP(j) * XS(j)$

20.$SG = YG - TGE - \sum_h TGH(h) - TGRM - G$

21.$YRM = [TERM + \sum_h THRM(h) + TGRM] * \frac{1}{E} + \sum_i PWM(i) * M(i)$

22.$SRM = YRM - [TRME + \sum_h TRMH(h) + TRMG] - \sum_i PWE(i) * EX(i) - TDRM$

C. Expenditures.

23.PC(i)*C(i,h)=PC(i)*Cmin(i,h)+B(i,h)*[CTH(h)-PC(i)*Cmin(i,h)]

24.CTH(h)=PMC(h)*YDH(h)

25.PC(i)*CG(i)=$\alpha(i) * G$

26.$PC(i) * INV(i) = \mu(i) * IT$

D. Prices.

27.PP(j)*XS(j)=PVA(j)*VA(j)+PCI(j)*CI(j)+TXP(j)

28.PVA(j)*VA(j)=W*LD(j)+R(j)*KD(j)

29.PCI(j)*CI(j)=$\sum_i[DI(i,j)*PQ(i)*(1-nass(i))*(1-exon(i))*(1+tcn(i))*credit(i)]+\sum_i[DI(i,j)*PQ(i)*(1-nass(i))*(1-exon(i))*(1-credit(i))]+\sum_i[DI(i,j)*PQ(i)*(1-nass(i))*(1-exon(i))*(1+tcn(i))*exon(i)]+\sum_i[DI(i,j)*PQ(i)*(1-nass(i))*exon(i)]+\sum_i[DI(i,j)*PQ(i)*nass(i)*(1-exon(i))*(1+tcn(i))]+\sum_i[DI(i,j)*PQ(i)*nass(i)]$

30.$PE(i)*(1+tex(i))=PWE(i)*E$

31.$PL(i)*DS(i)=PP(i)*XS(i)-PE(i)*EX(i)$

32.$PD(i)=PL(i)*(1+tx(i))$

33.$PM(i)=PWM(i)*E*(1+tmm(i))$

34.$PQ(i)*Q(i)=PD(i)*DD(i)+PM(i)*M(i)$

35.$PC(i)=PQ(i)*[1+tcn(i)*(1-exon(i))]$

E. International trade.

36.XS(j)=$A^e(j)*[\beta^e(j)*EX(j)^{\rho^e(j)}+(1-\beta^e(j))*DS(j)^{\rho^e(j)}]^{\frac{1}{\rho^e(j)}}$

37.$EX(i)=DS(i)*[\frac{PE(i)}{PL(i)}*\frac{1-\beta^e(i)}{\beta^e(i)}]^{\sigma^e(i)}$

38.$Q(i)=A^m(i)*[\beta^m(i)*M(i)^{-\rho^m(i)}+(1-\beta^m(i))*DD(i)^{-\rho^m(i)}]^{\frac{-1}{\rho^m(i)}}$

39.$M(i)=DD(i)*[\frac{PD(i)}{PM(i)}*\frac{\beta^m(i)}{1-\beta^m(i)}]^{\sigma^m(i)}$

F. Equilibriums.

40.Q(bns)=$\sum_h C(bns,h)+DIT(bns)+INV(bns)+CG(bns)$

41.$LEON=Q(ser)-\sum_h C(ser,h))-DIT(ser)-INV(ser)-CG(ser)$

42.$LS=\sum_j LD(j)$

43.$KS(j)=KD(j)$

44.$DS(i)=DD(i)$

45$EXS(i)=EX(i)$

46.$IT=\sum_h SH(h)+SE+SG+SRM*E$

Appendix 2.

Parametres.

v(j) Leontief coefficient of value added

io(j) Leontief coefficient of intermediate consumption

A(j) CES value added scale parameter

$\beta(j)$ CES value added distribution parameter

$\rho(j)$ Exponent of the CES value added function

$\sigma(j)$ Elasticity of substitution of the CES value added function

aij(i,j) Technical coefficients

$\lambda^l(h)$ Share of total household labor compensation

$\lambda^k(h)$ Share of total household capital compensation

$\lambda^k g$ Share of total government capital compensation

PMC(h) Average household propensity to consume

Cmin(i,h) Incompressible consumption of good i by household h

B(i,h) Marginal propensity to consume good i by household h

$\alpha(i)$ Share of government expenditure allocated to good i

$\mu(i)$ Share of investment of good i in total investment

$A^e(j)$ Scale parameter of the CET transformation function

$\beta^e(j)$ Distribution parameter of the CET transformation function

$\rho^e(j)$ Exponent of the CET transformation function

$\sigma^e(j)$ CET transformation elasticity

$A^m(i)$ CES composite demand function scale parameter

$\beta^m(i)$ Distribution parameter of the CES composite demand function

$\rho^m(i)$ Exponent of the CES composite demand function

$\sigma^m(i)$ Elasticity of substitution of CES composite demand function

tyh(h) Effective personal income tax rate on households

tye Effective corporate income tax rate

tyrm Effective personal income tax rate on the rest of the world

tcn(i) Effective VAT rate on good i

tmm(i) Effective tariff rate on good i

tex(i) Effective export tax rate on good i

tx(j) Effective production tax rate in each branch j

exon(j) Share of exempted goods in each branch j

nass(j) Share of non-liable producers in each branch j

credit(j) Share of non-refunded VAT by tax administration in each branch j.

Endogenous variables.

VA(j) Value added of branch j

XS(j) Total production of branch j

CI(j) Intermediate consumption of branch j

LD(j) Labor demand per branch

KD(j) Capital demand per branch

W Wage rate

R(j) Capital compensation rate per branch

DI(i,j) Intermediate good demand per branch

DIT(i) Total intermediate good demand of product i

YH(h) Household gross income

YDH(h) Household disposable income

SH(h) Household savings

YE Firms gross income

SE Firms savings

YG Government revenue

SG Government savings

SRM Savings of the the rest of the world

TDH(h) Personal income taxes

TDE Corporate income taxes

TDRM Rest of the world income taxes

TI(i) VAT on good i

TM(i) Custom duties on good i

TXP(j) Production taxes in branch j

TE(i) Export taxes on good i

C(i,h) Household consumption on good i

CTH(h) Household total consumption budget

CG(i) Public expenditure on good i

INV(i) Investment in good i

IT Total investment

PP(j) Per-unit cost of production

PVA(j) Value added price

PCI(j) Intermediate consumption price

PL(j) Local producer price in branch j

PE(i) Export price in branch j

DS(i) Domestic supply of good i

EXS(i) Export supply

EX(i) Export demand

PD(i) Domestic price of good i

PQ(i) Composite price of good i

DD(i) Domestic demand of good i

PM(i) Import price of good i

M(i) Import of good i

Q(i) Composite demand of good i

PC(i) Final consumption price of good i

Exogenous variables.

E Nominal exchange rate (numeraire)

LS Total labor supply

KS (j) Capital supply per branch

TRH(h) Received transfers by households

TVH(h) Paid transfers by households

AUTOE(h) Income of self-employment

TGH(h) Transfers of government to households

TRMH(h) Transfers of the rest of the world to households

TEE Between firms transfers

THE(h) Transfers of households to firms

TGE Transfers of government to firms

TRME Transfers of the rest of the world to firms

TEG Transfers of firms to government

THG(h) Transfers of households to government

TRMG Transfers of the rest of the world to government

TERM Transfers of firms to the rest of the world

THRM(h) Transfers of households to the rest of the world

TGRM Transfers of government to the rest of the world

YRM Income of the the rest of the world

G Total government spending

PWE(i) World export price of good i

PWM(i) World import price of good i

Appendix 3. Elasticities (table 4.12).

Table 4.12

	Agriculture	Industry	Private services	Public services
σ	0.7	0.9	0.8	0.6
σ^m	1.1	1.3	1.2	0.7
σ^e	1.2	1.1	1.3	0.7

Appendix 4. Simulation results

Table 4.13

	Sim1 changes in (%)
VA	AGR 0.407, IND -3.187, SER 1.232, PUB -1.516
XS	AGR 0.407, IND -3.187, SER 1.232, PUB -1.516
CI	AGR 0.407, IND -3.187, SER 1.232, PUB -1.516
LD	AGR 0.806, IND -6.302, SER 2.341, PUB -2.068
KD	AGR 0.000, IND 0.000, SER 0.000, PUB 0.000
W	AGR -10.04, IND -10.04, SER -10.04, PUB - 10.04
R	AGR -9.010, IND -16.323, SER -7.407, PUB -13.127
DIT	AGR -1.865, IND -0.754, SER 0.394, PUB 0.480
TI	AGR 10.708, IND 14.485, SER 13.190, PUB 10.884
TM	AGR -16.721, IND -12.966, SER -11.856
TE	AGR -1.306, IND -12.338
TXP	AGR -6.657, IND -3.626, SER 13.460, PUB -2.306
CG	SER -12.429, PUB -0.500
INV	AGR 5.963, IND -3.035, SER -13.722
PP	AGR -7.035, IND -0.454, SER 12.080, PUB -0.80
PVA	AGR -9.537, IND -13.257, SER -8.813, PUB -10.886
PCI	AGR 5.631, IND 3.153, SER 24.634, PUB 21.325
PL	AGR -7.484, IND -0.807, SER 13.562, PUB -0.807
PE	AGR 0.028, IND 0.051
DS	AGR -0.173, IND -3.565, SER 2.975, PUB -1.520
EX	AGR 9.630, IND -2.647, SER -12.717, PUB -0.960
DD	AGR -0.173, IND -3.565, SER 2.975, PUB -1.520
PD	AGR -7.484, IND -0.807, SER 13.562, PUB -0.807
PQ	AGR -7.118, IND -0.950, SER 12.297, PUB -0.803
PM	AGR -0.876, IND -1.021, SER -0.021
M	AGR -7.468, IND -3.295, SER 19.953, PUB -2.062
Q	AGR -0.605, IND -3.384, SER 4.368, PUB -1.522
PC	AGR -7.020, IND 1.608, SER 14.194, PUB 0.502
YH	Non-farmers -6.975, Farmers -5.047
YDH	Non-farmers -7.460, Farmers -5.650
SH	Non-farmers -7.460, Farmers -5.650
TDH	Non-farmers -6.975, Farmers -5.047
CTH	Non-farmers -7.460, Farmers -5.650
C (Non-farmers)	AGR -0.418 IND -8.328 SER -17.680 PUB -7.175
C (Farmers)	AGR 1.192 IND -6.729 SER -15.939 PUB -5.535
YE -5.664	SE -72.083 YG 1.935 TDE -5.664 TDRM 1.7E-14
SG 19.704	SRM 15.384 IT -1.476

Table 4.14

	Sim2 changes in (%)
VA	AGR 0.979, IND -0.809, SER 0.392, PUB -1.829
XS	AGR 0.979, IND -0.809, SER 0.392, PUB -1.829
CI	AGR 0.979, IND -0.809, SER 0.392, PUB -1.829
LD	AGR 1.944, IND -1.622, SER 0.742, PUB -2.492
KD	AGR 0.000, IND 0.000, SER 0.000, PUB 0.000
W	AGR -8.902, IND -8.902, SER -8.902, PUB -8.902
R	AGR -6.361, IND -10.542, SER -8.055, PUB -12.654
DIT	AGR -0.362, IND -0.221, SER 0.057, PUB -0.075
TI	AGR -100.000, IND 14.919, SER 14.306, PUB 11.840
TM	AGR -15.060, IND -12.811, SER -11.858
TE	AGR -2.063, IND -9.448
TXP	AGR -5.073, IND -1.990, SER 12.313, PUB -2.182
CG	SER -12.268, PUB -0.942
INV	AGR 5.459, IND -2.609, SER -13.548
PP	AGR -5.994, IND -1.190, SER 11.874, PUB -0.359
PVA	AGR -7.655, IND -9.730, SER -8.504, PUB -9.925
PCI	AGR 2.423, IND 1.216, SER 24.119, PUB 20.630
PL	AGR -6.373, IND -2.067, SER 13.333, PUB -0.362
PE	AGR 0.028, IND 0.051
DS	AGR 0.490, IND -1.776, SER 2.097, PUB -1.830
EX	AGR 8.789, IND 0.562, SER -13.233, PUB -1.581
DD	AGR 0.490, IND -1.776, SER 2.097, PUB -1.830
PD	AGR -6.373, IND -2.067, SER 13.333, PUB -0.36
PQ	AGR -6.067, IND -1.367, SER 12.091, PUB -0.360
PM	AGR -0.876, IND -1.021, SER -0.021
M	AGR -5.622, IND -3.124, SER 18.642, PUB -2.064
Q	AGR 0.130, IND -2.681, SER 3.456, PUB -1.831
PC	AGR -6.560, IND 1.181, SER 13.983, PUB 0.951
YH	Non-farmers -6.158, Farmers -4.392
YDH	Non-farmers -6.586, Farmers -4.917
SH	Non-farmers -6.586, Farmers -4.917
TDH	Non-farmers -6.158, Farmers -4.392
CTH	Non-farmers -6.586, Farmers -4.917
C (Non-farmers)	AGR -0.025 IND -7.162 SER -16.826 PUB -6.762
C (Farmers)	AGR 1.421 IND -5.677 SER -15.210 PUB -5.256
YE -4.896	SE -62.316 YG 1.960 TDE -4.896 TDRM 1.7E-14
SG 22.112	SRM 11.068 IT -1.459

Table 4.15

	Sim3 changes in (%)
VA	AGR -0.997, IND -2.932, SER 4.138, PUB -6.059
XS	AGR -0.997, IND -2.932, SER 4.138, PUB -6.059
CI	AGR -0.997, IND -2.932, SER 4.138, PUB -6.059
LD	AGR -1.953, IND -5.807, SER 7.994, PUB -8.150
KD	AGR 0.000, IND 0.000, SER 0.000, PUB 0.000
W	AGR -17.317, IND -17.317, SER -17.317, PUB -17.317
R	AGR -19.615, IND -22.634, SER -8.974, PUB -28.240
DIT	AGR -1.689, IND 0.427, SER 2.193, PUB 1.655
TI	AGR 1250.920, IND 22.777, SER 81.280, PUB 121.810
TM	AGR -25.949, IND -13.441, SER -19.120
TE	AGR 7.198, IND -11.847
TXP	AGR -15.091, IND -3.632, SER 17.731, PUB -11.777
CG	SER -19.270, PUB -4.558
INV	AGR 13.103, IND 1.668, SER -15.568
PP	AGR -14.236, IND -0.721, SER 13.053, PUB -6.087
PVA	AGR -18.456, IND -20.033, SER -13.473, PUB -20.362
PCI	AGR 7.136, IND 4.720, SER 28.991, PUB 25.235
PL	AGR -15.192, IND -1.264, SER 14.645, PUB -6.123
PE	AGR 0.028, IND 0.051
DS	AGR -2.320, IND -3.516, SER 6.049, PUB -6.084
EX	AGR 19.076, IND -2.102, SER -11.214, PUB -1.837
DD	AGR -2.320, IND -3.516, SER 6.049, PUB -6.084
PD	AGR -15.192, IND -1.264, SER 14.645, PUB -6.123
PQ	AGR -14.435, IND -1.101, SER 13.272, PUB -6.099
PM	AGR -0.876, IND -1.021, SER -0.021
M	AGR -17.721, IND -3.824, SER 24.949, PUB -10.134
Q	AGR -3.270, IND -3.722, SER 7.593, PUB -6.101
PC	AGR -7.531, IND 2.869, SER 23.869, PUB 4.776
YH	Non-farmers -11.983, Farmers -8.557
YDH	Non-farmers-12.816, Farmers -9.579
SH	Non-farmers -12.816, Farmers -9.579
TDH	Non-farmers-11.983, Farmers -8.557
CTH	Non-farmers-12.816, Farmers -9.579
C (Non-farmers)	AGR -5.052 IND -14.228 SER -27.613 PUB -15.206
C (Farmers)	AGR -1.792 IND -11.400 SER -24.769 PUB -12.389
YE -9.543	SE -121.456 YG 12.542 TDE -9.543 TDRM 1.7E-14
SG 131.136	SRM 11.648 IT 4.585

Table 4.16

	Sim4 changes in (%)			
VA	AGR -0.472, IND 0.643, SER 1.756, PUB -3.454			
XS	AGR -0.472, IND 0.643, SER 1.756, PUB -3.454			
CI	AGR -0.472, IND 0.643, SER 1.756, PUB -3.454			
LD	AGR -0.929, IND 1.300, SER 3.348, PUB -4.683			
KD	AGR 0.000, IND 0.000, SER 0.000, PUB 0.000			
W	AGR -12.043 , IND -12.043 , SER -12.043 , PUB -12.043			
R	AGR -13.208, IND -10.772, SER -8.347, PUB -18.800			
DIT	AGR 0.462, IND 0.873, SER 1.099, PUB 0.602			
TI	AGR 903.950, IND -11.916, SER 34.912, PUB 67.464			
TM	AGR -20.499, IND -12.523, SER -15.215			
TE	AGR 1.366, IND -7.750			
TXP	AGR -10.173, IND -0.919, SER 12.380, PUB -6.761			
CG	SER -13.031, PUB -2.337			
INV	AGR -2.743, IND -4.982, SER -19.608			
PP	AGR -9.747, IND -1.552, SER 10.440, PUB -3.426			
PVA	AGR -12.619, IND -11.405, SER -10.320, PUB -13.902			
PCI	AGR 4.801, IND 1.224, SER 22.915, PUB 19.562			
PL	AGR -10.379, IND -2.688, SER 11.734, PUB -3.446			
PE	AGR 0.028, IND 0.051			
DS	AGR -1.309, IND -0.633, SER 3.308, PUB -3.468			
EX	AGR 12.598, IND 2.448, SER -10.568, PUB -1.069			
DD	AGR -1.309, IND -0.633, SER 3.308, PUB -3.468			
PD	AGR -10.379, IND -2.688, SER 11.734, PUB -3.446			
PQ	AGR -9.862, IND -1.575, SER 10.650, PUB -3.432			
PM	AGR -0.876, IND -1.021, SER -0.021			
M	AGR -11.665, IND -2.803, SER 18.021, PUB -5.794			
Q	AGR -1.932, IND -2.091, SER 4.525, PUB -3.47			
PC	AGR -4.955, IND -2.715, SER 14.984, PUB 2.393			
YH	Non-farmers-8.343, Farmers -5.984			
YDH	Non-farmers -8.923, Farmers -6.699			
SH	Non-farmers -8.923, Farmers -6.699			
TDH	Non-farmers -8.343, Farmers -5.984			
CTH	Non-farmers -8.923, Farmers -6.699			
C (Non-farmers)	AGR -3.690	IND -5.954	SER -19.385	PUB -10.009
C (Farmers)	AGR -1.484	IND -3.858	SER -17.297	PUB -8.029
YE -6.688	SE -85.121	TDE -6.688	TDRM 1.7E-14	SG 0.000
SRM 4.917	IT -7.562			

Table 4.17

	Sim5 changes in (%)
VA	AGR 0.661, IND -0.911, SER 2.107, PUB -5.050
XS	AGR 0.661, IND -0.911, SER 2.107, PUB -5.050
CI	AGR 0.661, IND -0.911, SER 2.107, PUB -5.050
LD	AGR 1.310, IND -1.824, SER 4.025, PUB -6.814
KD	AGR 0.000, IND 0.000, SER 0.000, PUB 0.000
W	AGR -13.490 , IND -13.490 , SER -13.490 , PUB -13.490
R	AGR -11.867, IND -15.242, SER -9.117, PUB -23.090
DIT	AGR -0.351, IND 0.356, SER 1.051, PUB 0.518
TI	AGR 306.060, IND 4.206, SER 57.794, PUB 94.938
TM	AGR -19.570, IND -12.948, SER -17.068
TE	AGR 2.493, IND -9.523
TXP	AGR -9.129, IND -2.108, SER 14.127, PUB -9.003
CG	SER -16.067, PUB -3.872
INV	AGR 6.478, IND -2.016, SER -17.924
PP	AGR -9.726, IND -1.208, SER 11.772, PUB -4.16
PVA	AGR -12.693, IND -14.376, SER -11.455, PUB -16.152
PCI	AGR 5.298, IND 2.502, SER 25.728, PUB 22.146
PL	AGR -10.357, IND -2.097, SER 13.219, PUB -4.187
PE	AGR 0.028, IND 0.051
DS	AGR -0.183, IND -1.891, SER 3.829, PUB -5.067
EX	AGR 13.849, IND 0.479, SER -11.647, PUB -2.182
DD	AGR -0.183, IND -1.891, SER 3.829, PUB -5.067
PD	AGR -10.357, IND -2.097, SER 13.219, PUB -4.187
PQ	AGR -9.841, IND -1.377, SER 11.988, PUB -4.170
PM	AGR -0.876, IND -1.021, SER -0.021
M	AGR -10.633, IND -3.276, SER 20.509, PUB -7.854
Q	AGR -0.811, IND -2.821, SER 5.199, PUB -5.079
PC	AGR -8.162, IND -0.201, SER 19.143, PUB 4.027
YH	Non-farmers -9.303, Farmers -6.551
YDH	Non-farmers -9.949, Farmers -7.334
SH	Non-farmers -9.949, Farmers -7.334
TDH	Non-farmers -9.303, Farmers -6.551
CTH	Non-farmers -9.949, Farmers -7.334
C (Non-farmers)	AGR -1.720 IND -9.115 SER -22.767 PUB -12.168
C (Farmers)	AGR 0.729 IND -6.733 SER -20.384 PUB -9.876
YE -7.257	SE -92.365 YG 3.921 TDE -7.257 TDRM 1.7E-14
SG 53.678	SRM 8.868 IT -2.213.

Table 4.18

	Sim6 changes in (%)
VA	AGR 1.754, IND 1.491, SER 0.955, PUB -5.507
XS	AGR 1.754, IND 1.491, SER 0.955, PUB -5.507
CI	AGR 1.754, IND 1.491, SER 0.955, PUB -5.507
LD	AGR 3.502, IND 3.027, SER 1.812, PUB -7.420
KD	AGR 0.000, IND 0.000, SER 0.000, PUB 0.000
W	AGR -11.985, IND -11.985, SER -11.985 , PUB -11.985
R	AGR -7.549, IND -9.020, SER -9.987, PUB -22.597
DIT	AGR 1.208, IND 0.752, SER 0.482, PUB -0.274
TI	AGR -100.000, IND 4.636, SER 59.739, PUB 97.227
TM	AGR -16.569, IND -12.794, SER -17.085
TE	AGR 1.113, IND -6.592
TXP	AGR -6.259, IND -0.456, SER 12.691, PUB -8.848
CG	SER -15.957, PUB -4.498
INV	AGR 6.719, IND -1.694, SER -17.889
PP	AGR -7.875, IND -1.918, SER 11.626, PUB -3.536
PVA	AGR -9.817, IND -10.504, SER -11.050, PUB -14.934
PCI	AGR 1.960, IND 0.501, SER 25.250, PUB 21.477
PL	AGR -8.380, IND -3.318, SER 13.056, PUB -3.556
PE	AGR 0.028, IND 0.051
DS	AGR 1.086, IND -0.101, SER 2.640, PUB -5.521
EX	AGR 12.316, IND 3.734, SER -12.495, PUB -3.095
DD	AGR 1.086, IND -0.101, SER 2.640, PUB -5.521
PD	AGR -8.380, IND -3.318, SER 13.056, PUB -3.556
PQ	AGR -7.966, IND -1.786, SER 11.841, PUB -3.54
PM	AGR -0.876, IND -1.021, SER -0.021
M	AGR -7.299, IND -3.105, SER 18.923, PUB -7.872
Q	AGR 0.587, IND -2.122, SER 3.979, PUB -5.530
PC	AGR -8.450, IND -0.615, SER 18.987, PUB 4.709
YH	Non-farmers -8.221, Farmers -5.663
YDH	Non-farmers -8.793, Farmers -6.340
SH	Non-farmers -8.793, Farmers -6.340
TDH	Non-farmers -8.221, Farmers -5.663
CTH	Non-farmers -8.793, Farmers -6.340
C (Non-farmers)	AGR -0.331 IND -7.678 SER -21.768 PUB -11.678
C (Farmers)	AGR 1.863 IND -5.427 SER -19.524 PUB -9.542
YE -6.205	SE -78.973 YG 3.226 TDE -6.205 TDRM 1.7E-14
SG 50.827	SRM 4.920 IT -2.298

Appendix 5. Microsimulation equation.

PC(i)*C(i,h)=PC(i)*Cmin(i,h)+B(i,h)*[CTH(h)-PC(i)*Cmin(i,h)].

PC(i) Final consumption price of good i

C(i,h) Household consumption on good i

Cmin(i,h) Incompressible consumption of good i by household h

B(i,h) Marginal propensity to consume good i by household h

CTH(h) Household total consumption budget

Appendix 6. Structure of expenditures (% total expenditure, table 4.19).

Table 4.19

	Agriculture	Industry	Private services	Public services
Population	31.3%	29.3%	32.9%	6.5%
Farmers	35.7%	26.1%	29.7%	8.5%
Non-farmers	30.6%	29.8%	33.5%	6.1%

Appendix 7. Structure of expenditures rural-urban (% total expenditure, table 4.20)

Table 4.20

	Agriculture	Industry	Private services	Public services
Rural farmers	36.6%	25.8%	28.6%	9%
Urban farmers	39.4%	25%	29.3%	6.3%
Rural non-farmers	34.5%	26.5%	31%	8%
Urban non-farmers	29.5%	30.3%	34%	6.2%

General conclusion

This thesis studied tax transition (tax-tariff reform) in developing countries, a reform that consists in replacing revenue losses from international trade liberalization through domestic revenue mobilization. Initially, tax transition reform was intended to be revenue-neutral, otherwise, most of the sustainable development goals(SDGs) would suffer from means of implementation. Through four essays, the thesis analyzed what does or does not work around this reform, in a broader sense of tax policies needed to sustain this reform.

In the first essay, we addressed the role of value-added tax (VAT) and excise taxes in replacing border taxes in line with "first wave tax-tariff reform scheme". The results indicate nonlinear effects in the VAT-tariff compensation nexus with turning points, where VAT revenue effect becomes stretched after certain level of trade tax revenue losses. Hence, the need for developing countries is to restore overall neutrality to VAT through better tax administration and tax policy, quick to ensure more VAT revenue collection. Digitalizing for example, VAT tax administration and adopting unique tax identifier number are recommended, to enable increasing VAT efficiency and collection ratios. Concerning tax policy, countries should implement single VAT rate, remove VAT exemptions to restore neutrality to VAT in order to ensure efficiency over time.

In the second essay, we draw upon incomes taxes (personal and corporate income taxes) as well as property taxes as "second-generation tax reform tools". The thesis studied structural vulnerabilities faced by developing countries in collecting direct taxes, summarized as follows: tight corporate income tax base (CIT), evolution of corporate income tax according to commodity price evolvements, importance of informal sectors activities, aggressive tax planning of multinational firms, low administrative capabilities to audit and control taxpayers and tax evasion patterns, quality of information available to tax authorities to enforce taxation of self-employment incomes and independent activities (lawyers, doctors, accountants) for personal income taxes (PIT), and economic transactions that are mostly cash-based. These vulnerabilities limit the progression of direct taxes in countries. Empirical results suggest that except for the beneficial role of financial development, direct taxes are not operational in offsetting trade taxes as suggested by international financial institutions (IFIs). Here, the thesis recommends developing countries limiting cash-based transactions towards adopting more check and card-based transactions, and promoting financial inclusion of firms as ways for financial development to generate paper trails to tax administrations in order to enforce and raise more incomes taxes. Diversifying economic activities, is also suggested in order to help extend major tax bases and raise more direct taxes.

The third chapter analyzed the effect of implementing tax transition reform on the efficiency of collecting tax revenue and on doing businesses in WAEMU countries. WAEMU was selected due to the broad dimension of the reform at the community level. In addition, WAEMU countries expressly announced the adoption of the reform through community-based decision making, consultable in the agreement N° 10/2006/CM/UEMOA. Through appropriate "impact evaluation framework" the thesis tested the efficiency consequences of the reform at this community level, and on some indicators related to tax-oriented doing business climate in this area of countries. We found that, the reform is overall efficiency improving. This chapter also highlighted a number of results that can be analyzed as being themselves the consequences of achieved efficiency: improvement in tax-oriented doing business indicators at the community level (by increasing the contribution rate score of firms and by reducing collection time scores). These results suggest that, WAEMU countries should strive to maintain the tax policy framework that led to this performance, by reinforcing the best practices that surrounded the reform, such as the harmonization and coordination of tax policies among member countries, the modernization of their tax administrations, the use of new information and communication technologies, and the improvement of tax auditings, as well as the capacity building of their tax administrations' human resources.

Finally, the thesis ended with the social incidence of VAT-based tax transition in Togo. Building on a micro-macro computable general equilibrium model (CGE) with microsimultions on households' survey data, we analyzed the poverty and inequality implications of relying on VAT to compensate for the loss of revenues from tariffs. The results suggested that the reform is poverty and inequality increasing (regressive nature of the reform). But, accompanied with a redistributive pro-poor spending, this allows mitigating the negative incidence of the reform on households' income distributions and on poverty incidence at the country level. The thesis then recommends this country to implement social benefit policies in order to mitigate the impact of the reform on households' social outcomes.

At the end of this dissertation on tax transition reform, more general recommendations can also be made to countries in order to perform better with the level of their domestic revenue mobilization. In view of the overall lessons from chapters, we recommend that countries pay more attention to the quality of public revenue collection, i.e. the efficiency of revenue mobilization. This will avoid wasting time and scarce resources available for revenue collection by focusing efforts on taxes with a high taxpayers' willingness to pay. Positioning the tax transition reform, has allowed avoiding the maintenance in the tax system of distorting taxes such as custom duties

and export taxes, towards more efficient and less distorting taxes (VAT). This efficiency must also be looked for other taxes that make up the tax system, such as personal income tax (PIT), corporate income tax (CIT), and property tax (PT). To achieve this, countries should:

- Be always in search of a modern tax administration that increases transparency in the collection mechanisms, accountability and equity. This transparency can be achieved through the use of modern tax collection tools such as digitalization, internet, barcodes, and tax collection softwares. This would limit tax evasion, and increase accountability in the tax system.

- Educate taxpayers about taxes. A way to increase tax morale and tax compliance on the supply side of taxation is through education of taxpayers to tax laws. When taxpayers better understand tax mechanisms, it increases the quality of the collection process and reduces collection costs. The education of taxpayers to tax laws would be important in order to increase efficiency in the tax system.

- Increase the training of tax administration officials on the demand side of taxation. This would strengthen the links between the supply and demand side of taxation in order to build a more inclusive and well-designed tax system efficiency-oriented.

- Redistribute: either directly by increasing equity in the tax system of direct taxes through a better design of marginal income tax rates and simplification of tax brackets, or indirectly through spendings in direction of taxpayers as this has complementary links with taxation by making citizens more engaged and liable in face of tax duties.

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