CENTRE D'ETUDES
ET DE RECHERCHES
SUR LE DEVELOPPEMENT
INTERNATIONAL

SERIE ETUDES ET DOCUMENTS

Can the removal of VAT Exemptions support the Poor? The case of Niger

Céline de QUATREBARBES

Dorothée BOCCANFUSO

Luc Savard

Etudes et Documents n° 11

First version: March 2011
This version: May 2015

To cite this document:
Quatrebarbes C. de, Boccanfuso D., Savard L. (2015) "Can the removal of VAT Exemptions support the Poor? The case of Niger", *Etudes et Documents,* n°11, CERDI.
http://cerdi.org/production/show/id/1683/type_production_id/1

CERDI
65 BD. F. MITTERRAND
63000 CLERMONT FERRAND – FRANCE
TEL. + 33 4 73 17 74 00
FAX + 33 4 73 17 74 28
www.cerdi.org

The authors

Céline de Quatrebarbes
Research Fellow
FERDI, 63 Boulevard François Mitterrand, 63000 Clermont-Ferrand
Email : celine.de_quatrebarbes@ferdi.fr

Dorothée Boccanfuso
Professor
GREDI, Faculté d'administration, Université de Sherbrooke
Email : dorothee.boccanfuso@usherbrooke.ca

Luc Savard
Professor
GREDI, Faculté d'administration, Université de Sherbrooke
Email : luc.savard@usherbrooke.ca

Corresponding author: Céline de Quatrebarbes

This work was supported by the LABEX IDGM+ (ANR-10-LABX-14-01) within the program "Investissements d'Avenir" operated by the French National Research Agency (ANR)

Etudes et Documents are available online at: http://www.cerdi.org/ed

Director of Publication: Vianney Dequiedt
Editor: Catherine Araujo Bonjean
Publisher: Chantal Brige-Ukpong
ISSN: 2114 - 7957

Abstract

What is the best pro-poor value-added tax (VAT) design to increase public revenue in developing countries: A perfect uniform tax, a multiple-rate system, or a tighter tax base with a high rate? This debate remains relevant, even though many studies have analyzed the economic impact of VAT reforms. Most of these studies have considered VAT as a consumption tax when analyzing the social impact of VAT reforms. However, if VAT exemptions are implemented or if the tax administration is inefficient in issuing refunds for VAT credits, then VAT increases producer's tax burden and viewing the VAT only as a consumption tax becomes inaccurate. In order to take into account these complexities we built the first micro-macro computable general equilibrium model of Niger's economy in order to shed some light on the best pro-poor VAT design. The main result of the model reveals that broadening the tax base while maintaining a high VAT rate will lead to an important increase in poverty. Lowering the rate or maintaining exemptions on agricultural goods have the least impact on poverty. However, the social impact of exemptions depends on the net effect of the additional tax burden supported by producers and the increase in domestic demand.

Key words: Computable general equilibrium model, micro-simulation, value added tax, distributional analysis, Niger

JEL codes: D58, E62, H22, I32

Acknowledgment

We thank the participants at the ICTD conference organized by the Foundation for International Development Study and Research (FERDI) and S. Calipel for their helpful discussions. We also thank G. Chambas and A-M Geourjon for their valuable comments that improved this paper. The usual caveats apply as we remain responsible for what is presented in this paper.

1. Introduction

The combination of different taxes defines the government capacity to use its fiscal tools to achieve an economic (efficiency) and social (equity) optimum. The value added tax (VAT) is considered to be an efficient fiscal tool to generate public revenue but performing poorly in terms of equity. VAT reduces purchasing power since it is applied to consumption goods and since poor household have a limited capacity to save, they will be affected on a larger share of their total income. Hence, they will support a larger share of tax burden compared to non-poor households. In this context, direct taxation can be used to restore more progressivity in the fiscal system.

However, the traditional redistributive instruments (direct taxation and social transfers) are often weak tools in developing economies. According to Auriol and Warlters (2005), direct taxation represents less than 7% of GDP in sub-Saharan African countries compared to 22% in developed countries. The share of population receiving wage income is low and the capacity of government to tax other sources of revenues is also weak where direct taxation brings in less than 5-10% of fiscal revenues (Bird and Zolt 2014). From a theoretical stand point, public expenditure should allow to adequately target vulnerable social groups. However, many analysts (Filmer and Pritchett, 1999 et 2000; Gauthier, 2007 among others) highlight that this is empirically not verified. Hence, concerns equity and social justice have been steered towards indirect taxation and more specifically to VAT. In this context, impact analysis of VAT reforms should not only take into account efficiency issues but also distributional impact analysis.

Even though several empirical analyses assess the social impact of different VAT designs including exemptions, there is no consensus on the best pro-poor VAT design. Ahmad and Stern (1984, 1991) conclude that a multiple-rate or a uniform VAT system with exemptions is more progressive than the uniform rate system. Sahn and Younger (1999) find that, in five sub-Saharan countries, a reduced tax base was more progressive than both the uniform rate and multiple-rate VAT systems. Munoz and Cho (2003) find that the VAT system in Ethiopia is less progressive than the sales tax it replaced because the exempted goods are mostly consumed by non-poor households. Hossain (1995, 2003) find that a uniform VAT system in Bangladesh was regressive whereas Jenkins and al. (2006) show that the existence of an informal sector makes the unique VAT rate system more progressive. Most of these studies are performed in partial equilibrium micro-simulation contexts, and consider the VAT only as a consumption tax. In our application we try to go beyond this restrictive view by considering that VAT can also be an input tax.

In theory, VAT has always been considered as a consumption tax (Lauré, 1957). Liable producers transfer to the government the difference between the VAT collected on sales and the VAT paid on their inputs. With these mechanisms, intermediate inputs as well as investments are not affected by the tax. The value of the collected tax throughout the economic cycle is equal to the value of a consumption tax which would be levied on the selling price of the final good. VAT is therefore a tax on final consumption born by the consumer and collected by the producer. With tax abatement principle, VAT is theoretically neutral for the producer (Keen and al. 2001). However, in developing countries the VAT structure has become more complex. When VAT exemptions are given, officially for poverty reduction or social consideration, the final good is untaxed, and the VAT paid by the liable producer is not recoverable (i.e., VAT exemptions have more complex implications than applying a zero VAT rate; see Bovenberg, 1987; Tait, 1988; Gottfierd and al., 1991; Mackenzie, 1992; Ebrill and al. 2001; Chambas, 2005). The tax burden shifts from consumers to producers, and therefore, considering VAT as a simple consumption tax becomes inappropriate. Considering this situation as the baseline scenario, the social impact of exemption removal is difficult to define *a priori* and the usual partial equilibrium analysis is incomplete. According to Gautier (1999) among others, the end of exemptions not only increases consumer prices but also decreases production cost. Thus, a complete social evaluation of tax base expansion needs' to take into account both the producer's and the consumer's standpoints in a computable general equilibrium analysis.

Moreover, ending VAT exemptions would also force the government to choose a new VAT design: e.g. the same standard rate, a lower unique rate, or a multiple-rate system. The question of whether VAT should be uniform or differentiated has received much attention in the literature especially through the numerous development of the optimal tax theory (see, for example Ramsey 1927; Diamond and Mirrlees 1971; Atkinson and Stiglitz 1972; Sandmo 1974, 1976; Sadka 1977 and Keen 2007). Gautier (2001) summarized the main arguments: a single rate is intended to distribute the tax burden among all consumer goods while promoting economic efficiency; establishing a reduced rate on a few sensitive items seems to avoid *ad hoc* exemptions multiplications and protects consumers from a full tax rate. However, a multiple-rate VAT system also introduces competition between goods (substitution effect) and economic distortions. As usual, the debate becomes more complex when taking into account the well-known difficulties of public administration in developing countries (Shome 1995; Gautier 1999; Tanzi and Zee 2000; Bird 2014, Munk 2007). According to Ebrill and al. (2001), a uniform VAT system reduces the possibility of fraud and is easier to implement. In addition the probability of VAT credits is higher in a multiple-rate system than in a uniform one. A producer holds a VAT credit when the VAT collected by the producer is less than the amount of the VAT he paid. If VAT credits are not refunded, the producer has to support VAT on its inputs in the same way as in exemption situations, however the consumer would not benefit from the reduction in consumer prices allowed by exemptions.

In this paper we investigate the social impact of expanding the VAT base and test different VAT designs in the context of West African countries and more specifically for Niger. The options analyzed are: a tax base with no exemptions and the same statutory rate, a lower unique rate, a tighter tax base and finally a multiple-rate system. Considering the complexity of VAT administration in developing countries, and due to the interaction between markets and between economic distortions, the computable general equilibrium method seems the best method to capture the direct and indirect effects of different VAT reforms. To perform an-in-depth social analysis, a micro simulation model (Chen and Ravallion, 2004) that takes into account the heterogeneity of revenue and spending structures completes the CGE model. Given the sensitivity of VAT base expansion in Niger, the model is therefore applied to this country.

This paper is organized into four sections. Section 2 explains the debate about broadening the tax base in Niger. Key elements of the modeling of VAT complexity in the CGE micro-simulation model are presented in section 3. Section 4 describes the different scenarios and results, while the final section presents some concluding remarks.

2. Social Impact of VAT Design in Niger

The Niger belongs to the category of least developed countries with a ranking at 174th out of 177 country for the Human Development index and with 62% of the population living below the poverty line and 34% living in extreme poverty (UNDP, 2009). Like other developing countries, Niger is committed to achieving the Millennium Development Goals by 2015. To achieve these MDB goals, the government will need funds to finance its targeted public interventions.

The VAT was introduced in Niger in 1986. In 2000, to complete the tax-tariff transition and increase public funds, the VAT system evolved from a multiple-rate system[1] to a single rate of 19%, with a zero rate on exports. Although 19% is the highest VAT rate in the Western African Economic and Monetary Union (WAEMU), according to the available data, Niger remains one of the WAEMU nations with the lowest tax collection rate. In 2010, Niger had a tax revenue-gross domestic product (GDP) ratio of 13.4%, and its average was 10.1% from 1998 to 2005,[2] lower than the WAEMU average of 14.1% over the same period and the WAEMU target was 17%[3] of GDP. In 2010, collected VAT accounted for 30% of total tax revenue, 60% of government revenues, and 5% of GDP (Appendix A). Niger's VAT efficiency ratio[4] (0.24 in 2010) is lower than the average ratio for sub-Saharan countries (0.27 in 2010).

These low rates were primarily due to the increasing number of legal and illegal VAT exemptions (Barlow and Snyder 1994; Zafar 2005). Between 2003 and 2005, official exemptions represent, on average, more than 43% of 'internal VAT returns (Chambas 2005). To promote certain strategic goods and economic activities, the government exempted commodities consumed by impoverished households, as well as industrial goods and mining products. VAT exemptions became an instrument for economic and social policy. In addition to these legal exemptions, the prevalence of an informal sector and self-consumption further reduced the tax base. The effective VAT tax base is 43.1%[5] of total consumption in rural areas and 48.6% of total household consumption in Niamey (Chambas 2005).

[1] At the introduction of the VAT in Niger, there were three rates: 35%, 25%, and 15%. In 1994, these rates became 24%, 17%, and 10%. In 1998, Niger had to comply with Western African Economic and Monetary Union (WAEMU) directives on indirect taxation: The single VAT rate must be between 15% and 20%, harmonizing the nature of taxable goods and exemptions and allowing free choice for the application of VAT on farm property and excluding transportation activities. In January 2000, Niger established a single-rate VAT of 17%. In May 2000 (Loi N° 2000-03 du 2 mai 2000), the VAT rate climbed to 19%, with the establishment of a common external tariff and the expected decrease in customs revenue.

[2] Revenue except uranium

[3] In 2010, Senegal was the only country that met the WAEMU tax pressure rate target of 17% of GDP.

[4] Ebrill et al. (2001) found differences in the effectiveness of the VAT depending on the economic and social structure of countries and regions. The traditional measures are the ratio of VAT revenue to GDP divided by the standard VAT rate or the ratio of VAT revenue to final consumption divided by the standard VAT rate; that is, the single rate normally applied to all products. The efficiency ratio of a satisfactory VAT system is between 0.40 and 0.50.

[5] Chambas (2005)'s estimate for 2004 is based on data from National Accounts of Niger and VAT legislation.

Faced with this situation and to improve yields from internal indirect tax, the government of Niger has tried to expand the tax base to exempted goods[6]. In an inflationary context, these tax measures prompted violent social opposition, and WAEMU countries have assessed the possibility of returning to a multiple-rate VAT system. Since 2009, the WAEMU VAT directive has allowed a reduced VAT rate of 5% to 10% on certain items: edible oils, sugar, manufactured milk, pasta, animal feed, poultry, cornmeal, millet, sorghum, rice, wheat, fonio, agricultural equipment, computer equipment, and solar energy production equipment (2009 update on the 1998 WAEMU Directive).

Niger's experience shows that an evaluation of the social impact of different VAT designs is relevant to developing countries. What is the social effect of expanding the VAT tax base, and which is the best pro-poor VAT design to increase VAT revenue?

3. A CGE Model to Analyze a Pro-poor VAT Design

Computable general equilibrium (CGE) models have often been used to assess the macroeconomic impact of tax reforms (Shoven and Whalley 1984; Burgess and Stern, 1993). This method is more relevant than the partial equilibrium models, because it takes into account the substitution effect between goods and the cascade effect of the VAT on relative prices (Devarajan and Hossain 1998; Creedy 2001). Different general equilibrium models have been built to analyze effects of introducing or strengthening the VAT in various countries (Toh and al. 2005), especially in the case of a tax-tariff transition (Clarete and Whalley, 1987; Cockburn for Nepal, 2004). However, the VAT is often modeled as a uniform tax on final consumption (Serra Puche on Mexico 1984; Ballard and Shoven 1987), but as mentioned earlier, it does not act as such especially in developing countries.

Bovenberg (1987) using data for Thailand and Gottfierd and al. (1991) for Germany were the first to examine the consequences of the zero-rate VAT and exemptions in a computable general equilibrium. They concluded that the zero-rate VAT is a better instrument than tax exemption, even though they did not analyze the welfare effects. Giesecke and Nhi (2010) modeled different VAT systems in the presence of a multi-product production function in Vietnam. They concluded that a uniform rate without exemptions increases total consumption with adverse distributional consequences for rural households. The adverse distributional effects can be greatly ameliorated, at small cost to the aggregate welfare gain, through the exclusion of paddy and rice from the VAT. In a CGE analysis, Emini (2000) studied the introduction of a pure VAT system by broadening the tax base and with the passage of a uniform rate system versus a multiple-rate system in Cameroon. A pure VAT system seems to be more favorable than cascade taxes for economic activities that support an important ex ante tax burden. Increasing tax revenue through broadening the tax base is preferable to raising the VAT rate. Finally, the partial deduction of VAT credits distorts resource allocation. A few studies have taken into account the VAT's lack of neutrality but do not perform an in-depth social impact analysis to determine the best-pro poor VAT design.

[6] Since January 2003, rice has been subject to the VAT, edible oil since January 2004, and wheat flour, sugar and milk since January 2005. The agricultural sector is still excluded from the tax base due to its rudimentary nature.

To perform this social impact analysis on Niger, the macro CGE model was combined with a micro simulation model. To incorporate information from all of the available households and given the difficulty of including large household datasets as multiple agents in a CGE model (i.e., Cogneau and Robillard 2000), some researchers (Robillard and al. 2001; Chen and Ravallion 2004; Boccanfuso and Savard 2011) have adopted a sequential micro-simulation approach (i.e., a "top-down" approach). This model takes into account the heterogeneous income and expenditure structures of the households observed in the survey. In the first step, a single representative agent CGE model was utilized to calculate the estimated price changes (including factor prices) caused by a tax policy reform. These price changes are then fed into a micro-simulation household model in order to capture the impact on household income and expenditure. The model calculates new income and expenditure vectors and a household-specific price index after each simulation of the implemented economic policies. New real-income vectors are computed after each simulation, and thus, it is possible to estimate the poverty and inequality indices for each reference period and scenario. The "top-down" approach yields different qualitative and quantitative conclusions than a representative agent analysis (Savard, 2005), mainly because it evaluates the changes in intra-group distributions. This method can be improved by introducing feedback effects from the microsimulation model into the CGE model in what is called the "top-down bottom-up" (Savard 2003). According to Bourguignon and Savard (2008), there is no significant bias among these methods.

3.1. Characteristics of the CGE Model Used

The EXTER model (Decaluwé and al. 2001) was used as a starting point and modified to take into account the specificities of the economy of Niger and the complexity of VAT application in developing countries.

The production is determined by a nested production structure using three production factors: skilled labor, unskilled labor, and productive capital, in addition to intermediate inputs. Skilled labor is not used in the agricultural sector. A first level combines qualified and non-qualified labor with a CES function to obtain a combined labor factor. The value added is composed of labor and capital linked with a CES function for each sector. As is commonly assumed for developing economies, capital is sector specific. Intermediate consumptions are linked with fixed coefficients (i.e., the "Leontief function") and the same assumption applies to the total intermediate consumption, with the value added. This combination produces the total output of the production sector. Producers in each sector minimize costs subject to the technology constraints, just as described, and determine the optimal demand factor. The labor supply is endogenous and modeled based on the approach proposed by Annabi (2003)[7].

We model Niger's economy as a small open and price taker economy in the world market, which can satisfy all the domestic economy's importing and exporting needs. Considering the Armington (1969) assumption, imported and domestically produced goods of the same type are

[7] We used an exogenous labour supply to check robustness, and our results and conclusions were not modified by the assumption. We opted to present the results with the endogenous labour supply.

imperfect substitutes. Each product variety used by the domestic market in intermediate or final consumption corresponds to a combination of domestic production and imports with a constant-elasticity-of-substitution (CES) composite function. The price of imported goods takes into account the customs duty, excluding the VAT. The indirect tax applies directly to the composite goods. Similarly, a differentiation is made between exported goods and domestic sales. The decision to sell on the local market or to export locally produced goods is represented by a function with constant elasticity transformation (CET). The export supply is obtained by maximizing the producers' income from each market subject to the CET function. The problem of the non-reimbursement of exporters' VAT credits is set aside in this model. Export prices, therefore, were calculated on a net of VAT basis. The elasticities of the substitution and the transformation of the CES and CET functions are exogenously determined (Appendix D).

Households receive their income from production factor payments, state transfers, and remittances from the rest of the world. Households spend their income to consume goods and services, pay direct taxes, and save some funds. Household demand is represented by a linear expenditure system (LES) derived from the maximization of a Stone-Geary utility function. The distributional impact assessment of VAT reform on income distribution is performed with the micro simulation model.

Government revenue is generated from taxes (i.e., direct taxes, production taxes, import duties, export duties, and indirect domestic taxes such as the VAT and excise duties), grants, and foreign aid. Government revenue depends on exogenous tax rates and the endogenous tax base. International transfers are exogenous. The government provides public services, consumes various goods, and pays employees. Public savings are residual and correspond to the difference between the revenue and the sum of government spending and transfers from the state to households.

The model's equilibrium conditions and closure rule are traditional; the closure rule is based on the overall macroeconomic saving-investment balance in which the total value of investment matches the level of available savings (i.e., a "savings-driven" model). The total savings available in the country are the sum of foreign, household, and government savings. It is used to finance all the investment (public and private). The nominal exchange rate chosen is the numeraire. The current account balance is exogenous and balanced through the endogenous real exchange rate. Maintaining the current account at a constant level eliminates the scenario in which welfare is increased through additional foreign debt. Public spending is fixed, which is justified in a developing country such as Niger and corresponds to our analytical framework, distinguishing the effects of increased government revenue and the establishment of an effective policy to reduce poverty. For each market, the balance between supply and demand is obtained with a price adjustment. Transfers between the various agents are exogenous.

3.2. Specificities in Modeling the VAT

The VAT is theoretically neutral for producers. However, as mentioned earlier, producers selling exempted goods cannot be refund for the VAT paid on their inputs. Thus, the producer, instead of the consumer, bears the tax burden. The same principle is valid if tax authorities do not refund

VAT credits. Considering the VAT as a simple consumption tax becomes inappropriate, and this specificity needs to be addressed in the design of the CGE model.
The VAT is an *ad valorem* tax applied in the same way on imported and locally produced goods and services. In the model, the tax is applied to the price of composite goods, with customs duties included (i.e., imported and locally produced goods). Les exportations sont évaluées hors TVA. Une partie des biens disponibles sur le marché peut être exonérée de TVA par décision législative. Tenir compte des exonérations de certains produit nécessite d'appliquer le taux nominal de TVA uniquement à la proportion de biens non exonérés de TVA vendue par le secteur. Les données disponibles dans la MCS sont agrégées et ne reprennent pas le niveau de détail du code des impôts. La variable exo est donc comprise entre 0 et 1. La variable « exo= 1 » lorsque tous les biens i disponibles sur le marché sont exonérés de TVA mais « exo <1 » lorsque seulement une partie des biens i sont exonérés de TVA.

$$(1)\ \mathrm{PC_i} = \mathrm{PQ_i} * (1 + \mathrm{tcn_i} * (1 - \mathrm{exon_i}))$$

$\mathrm{PC_i}$: Consumer price; $\mathrm{PQ_i}$: composite price; $\mathrm{tcn_i}$: nominal VAT rate; $\mathrm{exon_i}$: proportion of VAT-exempted goods.

The proportion of taxed inputs depends on the structure of the sector. The model considers four types of producers in a single sector: (i) liable producers that do not hold VAT credits, (ii) liable producers selling exempted goods that cannot be refunded for the VAT paid on their inputs, (iii) liable producers that support VAT credits (i.e., with a bad credit reimbursement system), and finally, small, (iv) non- liable producers that cannot be reimbursed for the VAT paid on their inputs. The model has to take into account all these categories to represent as accurately as possible the tax situation of producers.

Non-liable producers (formal or informal) do not have to collect the tax for the government but cannot recover the tax paid on their input. According to the law of one price assumption hypothesis, non-liable producers selling a final consumption good align their selling price to the VAT-included price of the liable producers. They receive a margin paid by the consumer, which decreases their tax burden. In addition, non-liable producers selling intermediate consumption goods must align their price to the VAT-excluded price of liable producers. Thus, the non-liable producers must bear the input tax burden. La possibilité donnée par la loi de finance d'opter pour l'assujettissement volontaire des producteurs, amène à considérer que si le producteur décide de rester non assujetti malgré la charge de TVA supportée sur ses intrants, c'est que d'autres éléments entrent en ligne de compte (le paiement d'autres impôts par exemple) et que la TVA n'est pas seule à l'origine de cette décision. Cette possibilité nous donne la possibilité de considérer la proportion de la production des non assujettis comme exogène au modèle. It also may implicitly represent the situation of small producers or those in the informal sector.

The margin collected by non-liable producers selling final consumption goods:

$$(2)\ \mathrm{nass_i} * \beta\mathrm{cf_i} * (1 - \mathrm{exon_i}) * \mathrm{tcn_i} * \mathrm{PD_i} * \mathrm{DD_i}$$

$\mathrm{nass_i}$: non-liable production ; $\beta\mathrm{cf}_i$: part of the final good production ; $\mathrm{exon_i}$: proportion of VAT-exempted goods; $\mathrm{tcn_i}$: nominal VAT rate; $\mathrm{PD_i}$: domestic price; $\mathrm{DD_i}$: domestic demand;

Imperfections in applying the VAT induce cascade effect and increase the input price in the value-added equation:

$$(3) PV_i * VA_i = P_i * XS_i * (1 - tx_i) + marge_i - \sum_j \left(DI_{j,i} * nass_i * (1 - exon_j) * PQ_j * (1 + tcn_j)\right)$$
$$- \sum_j \left(DI_{j,i} * nass_i * exon_j * PQ_j\right)$$
$$- \sum_j \left(DI_{j,i} * (1 - nass_i) * exon_i * (1 - exon_j) * PQ_j * (1 + tcn_j)\right)$$
$$- \sum_j \left(DI_{j,i} * (1 - nass_i) * exon_i * exon_j * PQ_j\right)$$
$$- \sum_j \left(DI_{j,i} * (1 - nass_i) * (1 - exon_i) * credit_i * PQ_j * (1 + tcn_j)\right)$$
$$- \sum_j \left(DI_{j,i} * (1 - nass_i) * (1 - exon_i) * (1 - credit_i) * PQ_j\right)$$

(a) $P_i * XS_i * (1 - tx_i)$: Production value.

(b) $marge_i$: The margin collected by non-liable producers selling final consumption goods.

(c) $\sum_j \left(DI_{j,i} * nass_i * (1 - exon_j) * PQ_j * (1 + tcn_j)\right)$: The value of non-exempted intermediate consumption goods used by non-liable producers. The VAT paid on these inputs is not recoverable.

(d) $\sum_j \left(DI_{j,i} * nass_i * exon_j * PQ_j\right)$: The value of exempted intermediate consumption goods used by non-liable producers.

(e) $\sum_j \left(DI_{j,i} * (1 - nass_i) * exon_i * (1 - exon_j) * PQ_j * (1 + tcn_j)\right)$: The value of non-exempted intermediate consumption goods used by liable producers selling exempted items.

(f) $\sum_j \left(DI_{j,i} * (1 - nass_i) * exon_i * exon_j * PQ_j\right)$: The value of exempted intermediate consumption goods used by liable producers selling exempted items. The VAT paid on these inputs is not recoverable.

(g) $\sum_j \left(DI_{j,i} * (1 - nass_i) * (1 - exon_i) * (credit_i) * PQ_j * (1 + tcn_j)\right)$: The value of intermediate consumption goods used by liable producers selling non-exempted goods taxed by the VAT credit.

(h) $\sum_j \left(DI_{j,i} * (1 - nass_i) * (1 - exon_i) * (1 - credit_i) * PQ_j\right)$: The value of non-taxed intermediate consumption goods used by liable producers selling non-exempted goods.

The nominal rate of VAT (tcn_i), the proportion of non-liable producers ($nass_j$), the proportion of exempt property ($exon_i$), and the proportion of VAT credits ($credit_i$) are exogenous variables which endogenously change the tax burden on the productive sectors. Exempted goods are taken

out of the tax base regardless of their use (final or input goods). This variable is set during the calibration of the model. According to this equation, the end of the VAT exemptions reduces the cost of production in the sector by reducing the proportion of producers supporting VAT (part c of the equation), increases the value of tax credits for liable companies (part e of the equation) and modifies the net results of the cost of intermediate inputs and the margin recovered through alignment of prices for non-subject producers (part a and g of the equation). The VAT burden in the sector is dependent on endogenous policies implemented by the tax authorities. This model captures the impact of ending VAT exemptions on Niger's economy from the producers' standpoint.
Finally, VAT collected ($RTVA_i$) depends on the VAT base includes shares of both non-exempt, final-consumption sales by liable producers and intermediate inputs used by non-liable producers or liable producers selling an exempted good[8].

$$(4) RTVA_i = tcn_i * (1 - exon_i) * PQ_i * \sum_h C_{i,h} - marge_i + \sum_j DI_{i,j} * PQ_i * \left(nass_j + (1 - nass_j) * exon_j + (1 - nass_j) * credit_j\right) * tcn_i * (1 - exon_i)$$

tcn_i: nominal VAT rate; $exon_i$: proportion of VAT-exempted goods; PQ_i: composite price; $C_{i,h}$: final consumption ; $nass_i$: non-liable production ; PD_i : domestic price ; DD_i : domestic demand.

3.3. The Social Accounting Matrix of Niger

The macroeconomic model was applied to the 2004 social accounting matrix (SAM) of Niger's economy. The country's tax office provided information on its tax structure for 2006. The SAM has been aggregated into six sectors based on the level of disaggregation of VAT information available: agriculture, livestock, food processing, industry, private, and public services. (The aggregated sectors are presented in Appendix B, and the structure of Niger's economy based on the SAM in Appendix E.)

Niger's agricultural sector creates 21.93% of the national value added and 19.46% of total production. Agriculture is produced locally, imported (15.41% of the domestic demand), and exported (7.89% of production). In addition to agricultural activities, the food processing sectors (i.e., processed food and beverages) contributes 9.51% of the nation's total production and 5.4% of the national value added. This industry uses more inputs than agricultural production (its value added is 38.74% of the production value). Foreign trade is concentrated in the industrial sector (63.28% of total exports and 76.31% of total imports). Labor receives the largest share of value added, mostly from the agricultural sector (92.31%).

[8] Investment and public consumption are excluded from the VAT base.

The VAT data in the SAM were corrected with information provided by the General Directorate of Customs and the Direction of the Majors Enterprises. In Niger, the collected VAT is closer to gross collected VAT than to net value because of the difficulties in refunding VAT credits. Collected VAT was 5% of GDP in 2010. Of VAT revenue, 59.16% comes from the taxation of industrial goods, 20.10% from services, and 10.27% from food processing. The high proportion of VAT exemptions on agricultural goods and the prevalence of the informal sector explain the low VAT revenue from agricultural goods, while the non-refunded VAT credits explain the high level from industrial goods. The proportion $exon_i$ is calculated through an equation system to ensure a balance of VAT revenue for a given proportion of non-liable production in a given sector ($nass_i$). However, due to the limited information available in the field, we could not fix or even compare the value of our parameters to reality. The values of these parameters necessarily influence the effective VAT rate and the baseline tax burden on the producer. Therefore, we conducted a number of sensitivity analysis to determine the influence of our calibrated parameters on the results, which confirmed that there was no change in the trends observed in our results. In this study, considering Niger's economic structure, non-liable production ($nass_i$) represent 60% in agriculture and livestock, 30% in private services, and 20% of food processing. In each sectors, 50% of non-liable producer sell final consumption goods. Moreover, 20% of inputs of the industrial sector are exempted from VAT taxes given the structure of VAT credits. Considering that 90% of agriculture goods, 85% of transformed food, 47% of industrial items and 86% of services are VAT exempted. The small level of VAT revenue is also due to collection problems independent of VAT exemptions, which artificially increases the proportion of exempted goods when calibrating the model. The effective VAT rate on all goods is then well below the 19% defined by the Finance Act: nearly 1.2% on agriculture, 0% on livestock, 3% on food processing goods, 10% on industrial goods, and 2% on private services. The industrial sector supports the heaviest tax burden (4.26 % of production value), compared to 0.14% by the agricultural sector. This situation is linked to the weight of inputs taxed in the production process. (The main descriptive statistics are presented in Appendix C).

4. Simulations and Results

The macro-micro framework combining a CGE model with a micro-simulation model allows us to perform the distributive analysis of broadening the fiscal base to exempted goods in Niger. To implement this distributional analysis, we perform seven simulations producing specific macroeconomic and microeconomic effects. The simulations are summarized in Table 1 below.

4.1. Simulations

We performed seven simulations of different options for VAT reforms to analyze the influence of the size of the tax base and to determine the best pro-poor VAT design for Niger: a high single rate, a low single rate, a multiple-rate VAT system, or a tighter tax base. Simulation 1 reproduces the end of VAT exemptions with the actual nominal tax rate of 19%. For this simulation, the tax collected from the private sector is not transferred to households but allow for an increase in public revenues which generates an increase in public savings given the exogenous public expenditure. This increasing public savings will produce an increase in public investments. This is in line with the objective of increasing public funds to finance public infrastructure. The principle of equal yield tax analysis" (Shoven and Whalley. 1977) was applied in the following simulations. This analytical approach captured the impact of different scenarios by isolating the macroeconomic effects induced by the variation of public revenue, expenditures, and savings. The following simulations (2, 3a, 3b, 4a, 4b) analyses the design effect of the VAT for the same level of public revenue. In simulation 2, the nominal rate reduced from 19% to 9.5%, enabling the expansion of the tax base, to obtain the 17% of tax pressure ask by the WAEMU. To yield the government revenue observed in simulation 2, the size of the taxe base and the tax rate structure (unique and multiple rates) are fixed and the model computes the nominal rate in the following simulations.

In simulation 3a, we maintained the initial proportion of exempted agricultural item and applied a single nominal VAT rate to other goods. This simulation is more realistic considering the difficulties in taxing the agricultural sector a developing country. For simulation 3b, we maintained the current proportion of exemptions for both agricultural and food processing goods. In simulations 4a and 4b, we took into account the possibility that WAEMU countries will introduce a reduced rate of 5% to 10% on agricultural goods. In simulation 4a, we ended the VAT exemptions on all goods and applied a reduced VAT rate of 5% to agriculture; in simulation 4b, transformed food was also subject to the reduced rate. In both simulations, we assumed that the tax authorities could control and repay VAT credits to producers. In simulation 5, agriculture and transformed food were subject to the reduced rate, and producers had to support cascading effects due to inefficient reimbursement of VAT credits by the tax administration. 80% of liable producers selling goods taxed at the reduce rate bore VAT credits. This final simulation was made without the budget neutrality hypothesis in order to understand the impact of this VAT system on public finance. The simulations are summarized in Table 1.

Table 1 : Summary of the simulations

Exogenous VAT Rate, Endogenous Public Revenue	
Sim 1	Without budget neutrality, 19% unique VAT rate, end of VAT exemptions, perfect management
Sim 2	Without budget neutrality, 9.5% unique VAT rate, end of VAT exemptions, perfect management
Endogenous VAT Rate, Exogenous Public Revenue (equal to simulation 2)	
Sim 3a	Budget neutrality, initial agricultural exemptions, uniform VAT rate on other goods, perfect management
Sim 3b	Budget neutrality, initial exemptions on agriculture and staple food, uniform nominal VAT rate on other goods, perfect management
Sim 4a	Budget neutrality, end of VAT exemptions, 5% reduced rate on agriculture, VAT credits refunded, perfect management
Sim 4b	Budget neutrality, end of VAT exemptions, 5% reduced rate on agricultural and staple food, VAT credits refunded
Exogenous VAT Rate, Endogenous Public Revenue	
Sim 5	Without budget neutrality, 5% reduced rate on agricultural goods and staple food, VAT credits not refunded, 80% of liable producers selling item taxed at the reduce rate bearing VAT credits

4.2. Macroeconomic and sectorial result

The first important observation, before proceeding to the distributional analysis, is that the VAT designs generate different macroeconomic and sectorial results. The macroeconomic results are presented in Table 2 and sectoral results in Table 3.

Implications of Ending VAT Exemptions (Simulations 1 and 2). Ending exemptions from the 19% nominal VAT rate helps raise government revenue (+72.8%). On the other hand, it causes a significant contraction in economic activity across sectors (except in the industrial sector) due to a sharp drop in demand. Under the assumption that the government will not change its current expenses, the increased tax revenue allows an increase in public savings and, therefore, total saving available for investment. Total investment increases, changing the structure of demand for capital goods (mainly industry) to the detriment of consumer goods. Because of a higher effective rate of the VAT, the end of VAT exemptions accelerates the decline in demand for consumer goods. The consumer price, VAT included, increases for private commodities, while the prices, VAT excluded, decrease. Simulation 1 has an direct impact on costs of production through a change in input prices. It reduces production costs for liable producers selling exempted items but increases the price of inputs goods for non-liable producers selling inputs, which had benefited at the baseline from exempted inputs. On average, the price of inputs decreases for all sectors but not enough to compensate for the reduction in production prices and causes the value-added price to decrease for all private sectors, except industry. Labor demand is stimulated in the industrial sector. Wages decrease for unskilled workers (-3.18%) and increase for skilled workers (+6.89%). Finally, only industrial sector derives advantage from the end of VAT exemptions and can expand its production. The additional demand for capital goods is mainly satisfied by an increase in demand for locally produced goods. Even if demand for all final composite goods decreases, the demand for imported goods declines more.

This simulation illustrates that, through a sharp drop in final demand, maintaining a high nominal VAT rate counteracts the effects of lower input costs for producers. Reducing the nominal rate to 9.5% (simulation 2) increases the national tax pressure to 17 % of GDP, near the WAEMU target. VAT revenue equals 7.6 % of GDP, assuming perfect VAT collection. Lowering the nominal VAT rate diminishes the tax base expansion's impact on local production by supporting demand. The producer price is higher than in simulation 1. The decrease of the nominal rate reduces the tax burden for non-liable producers selling intermediate consumption goods.[9] Finally, unit production costs decrease but less than under a 19% VAT rate due to a higher composite price, excluding VAT. The value-added price decreases are smaller than simulation 1 in all sectors. There is a small increase to non-skilled (+0.07%) and skilled wages (+4.24%). In GDP (at constant prices), a 9.5% nominal rate maintain national value added (+0.01%) compared to a 19% VAT rate (-0.34%).

[9] Sensitivity analysis was conducted assessing the proportion of taxed inputs for non-liable producers. The trends of the results did not change with a reduction of the proportion of taxed inputs for non-liable producers in all sectors.

Implications of Maintaining VAT Exemptions for food Items (Simulations 3a and 3b). Under the assumption of budget neutrality with the simulation 2, exempted agricultural goods increase the nominal tax rate on other goods (9.5% to 12%). Maintaining exemptions for agricultural goods, however, decreases the effective tax rate on these products and supports demand for VAT-exempted goods and an increase in producer prices. Unlike under the single-rate VAT system, the increase in demand favors imports over locally produced goods. Indeed, the price of domestic agricultural goods increases relative to the constant import price (the “small country” hypothesis). Maintaining agricultural VAT exemptions increases the tax burden of liable producers selling exempted items, which a 100% tax base does not (simulation 2). With VAT exemptions, the VAT paid by liable producers is not recoverable. The tax burden borne by other sectors, though, decreases due to the use of exempted items in production. The value-added price decreases more than in simulation 2. Finally, the value-added prices of all sectors decline more than under a single rate, and skilled and non-skilled wages are lower than in other simulations. Adding exemptions to staple food (simulation 3b) creates the highest nominal tax rate for non-exempted goods (14% compared to 12% in simulation 3a). Once again, it positively changes the structure of demand for exempted goods and reduces the tax burden borne by agricultural producers that use food processing goods as inputs, but increases production costs in other sectors (due to a higher full tax rate on inputs). Non-skilled wages decrease slightly, while skilled wages increase. Finally, except for industry, the value-added creation diminishes. At constant prices, the GDP declines -0.04% if only agricultural products are exempted (simulation 3a) and -0.08% (simulation 3b) if staple food items are also exempted.

Implications of the Introduction of a Reduced VAT Rate on Food Items (Simulations 4a, 4b, and 5). Under the budget neutrality hypothesis, ending VAT exemptions and introducing a reduced rate of 5% on agriculture goods require an increase of the nominal VAT rate to 11% (simulation 4a) and 13% (simulation 4b) if all staple food is also taxed at the reduced rate. This nominal rate increase is less than in the previous simulation. This VAT design reduces consumer prices and increases the demand and producer prices for the agricultural sector and food processing more than the unique rate of 9.5% but less than exemptions. In a multiple-rate system, liable producers do not have to support VAT on their input. In this case, VAT tax burden borne by producers decreases, as under the unique rate in simulation 2. Finally, the value-added price decreases less than under exemptions and is close to that of the unique-rate VAT system. The extra demand is mainly satisfied by an increase in demand for locally produced goods. The national value added is close to that of a unique rate system, with a 0.17% (simulation 4a) or a 0.24% decrease in GDP (simulation 4b). However, according to our results, if VAT credits are not refunded, the macroeconomic conclusions change. For the same effective VAT rates on final consumption, economic activity contracts to a greater extent. The non-reimbursement of VAT credits increases government revenue and, thus, benefits the industrial sector through the rise in total investment). The existence of VAT credits, though, leads to an increase in unit production costs, which is less than under exemptions. If VAT credits are not refunded, production costs increase as under exemptions, but consumers do not benefit from the zero rate as they would with exemptions.

The macroeconomic results illustrate that broadening the VAT base associated with the uniform rate of 9.5% allows increasing revenues to 17% of GDP which corresponds to the objective of WEAMU countries while maintaining the GDP relatively stable. For the same public revenue level, both the application of a reduced rate or the VAT exemptions options reduce the economic efficiency of the tax but less compared to maintaining the initial nominal VAT rate of 19%.

Table 2 : Macroeconomic Results for Each Simulation

Variables	Units	Baseline	Sim 1	Sim 2	Sim 3a	Sim 3b	Sim 4a	Sim 4b	Sim 5
				VAT Design					
Full rate of VAT	Percentage	19	19	9.5	12	14	11	13	13
Reduced rate of VAT	Percentage	No	No	No	No	No	5	5	5
Exemptions of VAT		Yes	No	No	Yes	Yes	No	No	No
Public Finance					*(% of variation)*				
Public Revenue (YG)	Billion FCFA	211.4	72.8	26.5	26.5	26.5	26.5	26.5	31.9
VAT Collected	Billion FCFA	66.1	219.5	78.9	78.6	77.8	78.8	78.7	94.5
					(in %)				
VAT/YG	Percentage	31.3	57.8	37.4	37.3	37.1	37.3	37.3	46.1
VAT/GDP	Percentage	4.2	13.6	7.6	7.6	7.6	7.6	7.6	8.3
YG/GDP	Percentage	1.6	23.5	17	17	17	17	17	17.9
Labor Market					*(% of variation)*				
Skilled Wage	Parameter	1	6.89	4.24	3.81	3.52	4.00	3.84	4.07
Non-skilled Wage	Parameter	0.5	-3.18	0.07	-0.52	-0.87	-0.18	-0.26	-1.05
Qualified Labor Supply	Billion FCFA	53.87	0.8	0.5	0.45	0.42	0.47	0.45	0.48
Non-Qualified Labor Supply	Billion FCFA	2454.64	-0.39	0.01	-0.06	-0.1	-0.02	-0.03	-0.13
Capital Market					*(% of variation)*				
Agriculture	Parameter	1	-13.9	-4.08	-4.98	-5.42	-4.3	-4.42	-6.35
Livestock	Parameter	1	-5.85	-1.26	-1.8	-2.06	-1.52	-1.46	-2.49
Food processing	Parameter	1	-13.31	-3.51	-4.42	-5.52	-3.95	-3.24	-6.95
Industry	Parameter	1	32.01	14.26	14.2	14.15	14.11	13.79	16.49
Services	Parameter	1	-9.57	-2.12	-2.96	-3.47	-2.52	-2.74	-3.97
Macroeconomics variables					*(% of variation)*				
Total Investment	Billion FCFA	216.04	69.46	26.05	25.7	25.5	25.9	25.85	30.72
Gross Production Value (GDP)[10]	Billion FCFA	1557.75	-0.34	0.01	-0.04	-0.08	-0.01	-0.02	-0.1

Source: CGEM results with 2004 SAM data, considering the authors' hypotheses.

[10] Sensitivity analysis was performed assuming exogenous labor supply: GDP decreases by 0.06% for simulation 1, -0.01% for simulation 2, -0.011 for simulation 3 and 4 and -0.01% for simulations 4a and 4b and finally -0.1% for simulation 5.

Table 3 : Sectorial Results for Each Simulation

			(% of Variations)						
variables		Baseline	Sim1	Sim2	Sim3a	Sim3b	Sim4a	Sim4b	Sim5
Production (XS)	Agriculture	441.98	-8.38	-3.11	-3.37	-3.44	-3.10	-3.13	-4.02
	Livestock	345.17	-2.05	-0.99	-0.96	-0.89	-1.00	-0.89	-1.08
	Food processing	218.20	-8.75	-3.00	-3.28	-3.91	-3.16	-2.53	-4.95
	Industry	412.95	25.40	10.19	10.62	10.88	10.28	10.13	12.68
	Services	623.58	-5.27	-1.77	-1.98	-2.10	-1.89	-1.99	-2.37
	Public Services	259.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumption (C)	Agriculture	42908.23	-10.58	-3.86	-3.25	-3.31	-3.48	-3.52	-4.32
	Livestock	22465.20	-11.49	-4.33	-4.62	-4.77	-4.50	-4.66	-5.37
	Food processing	18790.59	-11.63	-4.11	-4.53	-3.71	-4.35	-3.57	-4.88
	Industry	22900.72	-5.88	-1.69	-1.92	-2.06	-1.82	-1.96	-2.38
	Services	28931.50	-14.30	-5.05	-5.49	-5.73	-5.31	-5.56	-6.48
	Public Services	2337.00	-10.65	-3.31	-3.44	-3.51	-3.37	-3.40	-4.26
Domestic demand (DD)	Agriculture	406.93	-9.09	-3.34	-3.31	-3.39	-3.20	-3.23	-4.11
	Livestock	287.07	-3.61	-1.48	-1.65	-1.76	-1.59	-1.60	-1.93
	Food processing	216.06	-8.81	-3.03	-3.31	-3.89	-3.19	-2.55	-4.93
	Industry	242.24	23.24	9.22	9.40	9.51	9.24	9.11	11.21
	Services	619.79	-5.31	-1.79	-2.00	-2.13	-1.91	-2.01	-2.39
	Public Services	259.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Importation (M)	Agriculture	63.05	-16.17	-5.77	-2.66	-2.85	-4.42	-4.35	-5.16
	Livestock	0.86	-13.10	-4.71	-6.20	-7.31	-5.49	-6.23	-7.41
	Food processing	42.19	-15.16	-5.70	-6.34	-1.74	-6.06	-5.30	-2.73
	Industry	351.99	19.58	7.55	7.31	7.16	7.43	7.35	8.70
	Services	3.18	-12.04	-4.11	-5.26	-5.95	-4.69	-5.16	-6.26

Source: CGEM results with 2004 SAM data, considering the authors' hypotheses.

4.3. Distributional Analysis

Based on the "Questionnaire Unifié sur les Indicateurs de Base du Bien-être" (QUIBB_2005) including 6,690 households, the micro simulation model used allows the application of an in-depth distributional analysis of tax policy changes. Household' expenditures and income data from the survey were harmonized with the data from the SAM[11].

The poverty analysis was performed using the conventional Foster, Greer and Thorbecke (1984) poverty indices (FGT),[12] which covers poverty incidence, depth, and severity. The poverty line used was 105,827 CFAF per year per capita in rural areas and 144,750 CFAF in urban areas in 2005 (QUIBB, 2005). The Gini index was used to measure inequalities. Households were divided into four groups based on two criteria: place of residence (urban, rural) and the main activity of the head of household (farmers and non-farmers). The four groups analyzed are the urban farmers (Uagr, 3% of the population), rural farmers (Ragr, 63%), urban non-farmers (Unagr, 14%), and rural non-farmers (Rnagr, 20%).

[11] This was done with the same method as in Boccanfuso et al (2007).
[12] The distributional analysis was conducted by using Distributive Analysis Stata Package (DASP) software.

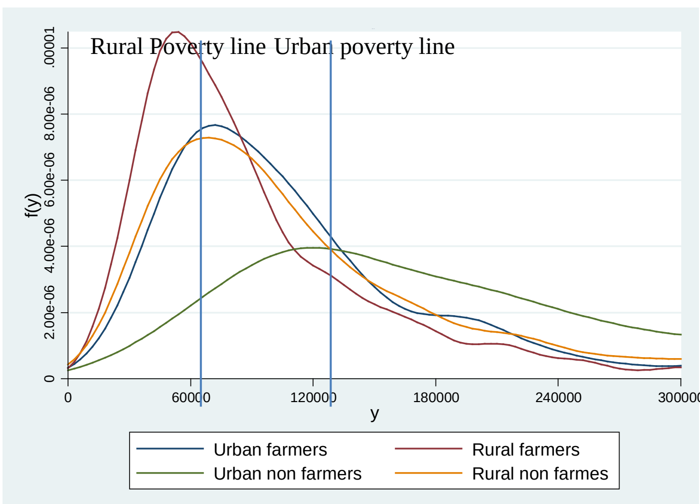
Poverty incidence for Niger at the reference period is 62.22%, depth is at 25.67 (FGT_1) and severity (FGT_2) at 13.41 (Table 4). Regardless of the place of residence, a relationship exists between farm households and the poverty level. Urban non-farmers have the lowest poverty rate (36.62%) follows by rural non-farmers (55.01%), while rural and urban farmers have higher poverty levels (resp. 69.73% and 71.58%). The national Gini coefficient is 0.44. When we decompose inequality, intra-group inequality explains 27.33% of the total inequality whereas intergroup explains 56.94% of total inequality. Overlapping inequalities represent the remainder i.e. 15.72%. Regardless of the group examined, the level of group inequality is similar, although urban non-farmers exhibit a slightly higher Gini value.

Table 4: Indices of Poverty and Inequality in Niger

	Niger	Urban farmers	Rural farmers	Urban non-farmers	Rural non-farmers
Share of population	100%	3.05%	62.95%	13.70%	20.30%
Incidence (FGT_0)	62.22%	71.58%	69.73%	36.62%	55.01%
Depth (FGT_1)	25.67%	31.08%	29.89%	12.03%	20.89%
Severity (FGT_2)	13.41%	16.45%	15.95%	5.46%	10.41%
Gini	0.46	0.41	0.44	0.43	0.42

Source: Authors' calculations based on data from the QUIBB_2005.

Figure 1 : Density Curve of households' revenue



Source: Authors' calculations based on data from the QUIBB_2005 using DASP.

At the national level, the three poverty indices increase for all simulations performed (cf. Table 5). Broadening the VAT base combined with a tax rate at 19% (simulation 1) is the option with poverty increases the most for the country (+4.57%). For a tax revenue level of 17% of GDP, the decrease in the VAT rate from 19 to 9.5% (simulation 2) reduces the impact compared to simulation 1 for all poverty indices. This finding is dependent on the CGE model closure used. Indeed, the increase in tax income from the private sector is obtained from households but

increases public savings. As seen with macroeconomic results, this is compatible with stylized facts in Niger where an increase in tax revenues produces an increase in poverty.
With the budget neutrality hypothesis, we compared the impact of the VAT structure on the poverty indices (Simulation 3a, 3b, 4a and 4b) compared to the results of simulation 2 (single tax rate at 9.5%). The single tax rate, maintaining exemptions or the multiple VAT rates on agricultural goods generate similar results. Exempting all staple food (simulation 3b) seems to be the most favorable option for poor households whatever poverty index used. Poverty decomposition by groups allows for the identification of most vulnerable groups to the broadening of the tax base and a change in the VAT structure.

For a tax burden at 17% of GDP, the broadening of the tax base to exempted goods while diminishing the rate at 9.5% (simulation 2) produces an increase in the two wages and hence this is favorable to households with a high share of wage income. The number of employed also increases. However, the rental rate of capital decreases with a stronger reduction in the agricultural sector. This has a negative impact of households mostly endowed with capital. The increase in the price of agricultural goods is higher compared to other prices which contribute to penalizing the households with a larger share of food expenditure in their total consumption basket. These factors contribute to generate a relatively strong increase in poverty for rural non farmers (+1.94%) compared to the increase of 1.06% for rural farmers. The effects are stronger for farmers compared to non-farmers for the depth and severity indices and this trend is valid whether the households reside in urban or rural zones.

Table 5: Nominal changes in poverty indices for each simulation (%)

Simulation	Indices FGT	Niger	Uagr	Ragr	Unagr	Rnagr
Share of population			3.05	62.95	13.70	20.30
Sim1	ΔFGT_0	4.57**	4.20*	4.01**	5.46**	5.74**
	ΔFGT_1	3.35**	4.05**	3.60**	2.46**	3.10**
	ΔFGT_2	2.19**	2.93**	2.47**	1.35**	1.79**
Sim2	ΔFGT_0	1.38**	1.95	1.06**	1.85**	1.94**
	ΔFGT_1	1.09**	1.33**	1.19**	0.79**	0.91**
	ΔFGT_2	0.66*	0.[illegible]2**	0.76**	0.42**	0.47**
Sim3a	ΔFGT_0	0.99**	0.87	0.70**	1.84**	1.34**
	ΔFGT_1	0.67**	1.18**	0.68**	0.76**	0.52**
	ΔFGT_2	0.38**	0.82**	0.41**	0.39**	0.23**
Sim3b	ΔFGT_0	0.98**	1.19	0.71**	1.78**	1.26**
	ΔFGT_1	0.63**	1.10**	0.64**	0.67**	0.51**
	ΔFGT_2	0.37**	0.77**	0.40**	0.34**	0.24**
Sim4a	ΔFGT_0	1.20**	1.63	0.87**	1.96**	1.64**
	ΔFGT_1	0.83**	1.22**	0.87**	0.78**	0.67**
	ΔFGT_2	0.49**	0.85**	0.54**	0.41**	0.33**
Sim4b	ΔFGT_0	1.16**	1.95	0.87**	1.78**	1.51**
	ΔFGT_1	0.78**	1.15**	0.83**	0.71[illegible]*	0[illegible]63**
	ΔFGT_2	0.47**	0.81**	0.52**	0.37**	0.32**
Sim5	ΔFGT_0	1.44**	2.11	1.05**	2.26**	2.02**
	ΔFGT_1	1.05**	1.51**	1.12**	0.88**	0.89**
	ΔFGT_2	0.64**	1.06**	0.72**	0.46**	0.46**

Authors' calculations. Results of the micro simulation on DASP. *Significance threshold of 10%;**Significance threshold of 5%.

Maintaining VAT exemptions on agricultural goods (simulation 3a) produces a decrease in the non-qualified wage and decreases employment as opposed to simulation 2. However, it reduces the losses of rental rate of agricultural capital as well as the increase in price for this good with both effects favoring poorer households. Hence, the poverty increases are weaker for the single VAT rate for all households with the exception of urban non-farmers for which we observe no significant change. Exemptions on agricultural goods also allow reducing depth and severity indices for rural households compared to the single VAT rate without negatively impacting the urban households. However, broadening the exemption to all staple food (simulation 3b) seems to have a weaker compensatory effect compared to simulation 3a for certain groups such as the urban farmers . Farmers living in rural or urban zones will experience a weaker increase in poverty headcount index. The discrepancy between farmers and non-farmers disappears for the depth and severity indices. Hence, the VAT reform that allows to increase the share of fiscal revenues up to 17% of GDP while have a limited negative impact on the poorest segment of the population (farmers) consist in maintaining the exemption on staple food (simulation 3b).

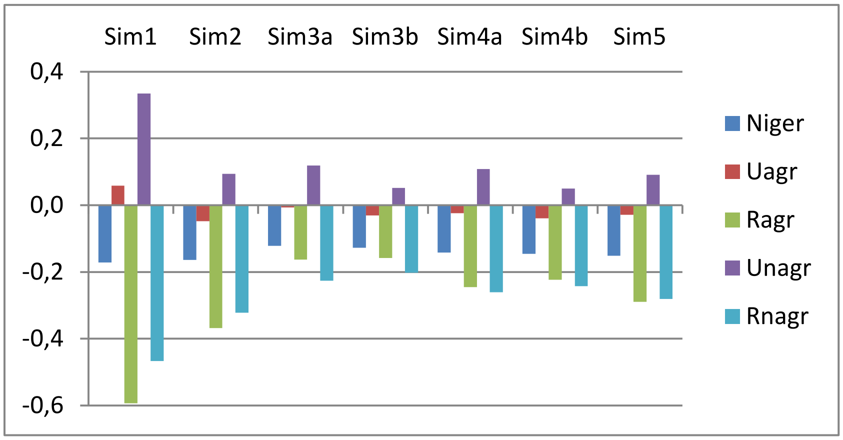
Introducing multiple VAT rates (simulation 4a and 4b) generate higher wages compared to the exemption scenarios. However, the staple food prices increase more and therefore the three poverty indices increase more for all households compared to simulation 3a. These increases are still weaker compared to the ones observed for the single rate option (simulation 2) and this is valid for all groups of households. If we remove the budget neutrality hypothesis between simulations when 80% of firms are subject to the VAT since selling goods at reduced rates that are not reimbursed (simulation 5), the negative effects on headcount, depth and severity indices are stronger than the ones obtained for all other simulations for all groups of households.

As illustrated in Figure 2[13], inequalities fluctuate differently for each group and for the different simulations. The most favorable scenario is simulation 2 at the country as well as for all groups except urban non-farmers. Simulations 3a and 3b (exemptions on agricultural goods and staple food) produce the weakest reduction in inequality for rural farmers (poorest group). The reduced rate (simulation 4a and 4b) generates stronger reduction in inequality for farmers compared to simulation 3a and 3b. Considering this in combination with the poverty changes for this group provides interesting insight for policy maker if targeting the farmers is an objective of the government.

---

[13] See Appendix **G**, for detail of the changes in the Gini Index.

Figure 2 : Variation in the Gini Index (%)



Source: Authors' calculations, results of the micro simulation on DASP.

The description of the changes in income distribution completes our analysis. For each simulation, we represent the changes in the distribution of income with the growth incidence curves (GIC). These GIC measure the growth rate of income between two distributions for each percentile of income ranked from the poorest households to the richest (Chen and Ravallion, 2003; Bourguignon and Savard, 2008; Boccanfuso and Ménard, 2009). For comparative purpose, we only consider here the budget neutral simulations (simulation 2, 3a, 3b, 4a and 4b).

For all five simulations we observe a reduction in income on one hand but also a change in the shape of the distribution (Figure 3 to 7). Whatever VAT structure option, we observe a reduction in income compared to the reference period and the households at the bottom of the distribution are the ones facing the weaker negative impact. The strongest negative effects are observed for simulation 2 with the single rate (Figure 3) compared with the exemptions on agricultural and staple goods scenarios (Figure 4, Figure 5). We also note that the differences between simulation 4a and 4b are very small (Figure 6, Figure 7).

Figure 3 : GIC simulation 2 (Niger)

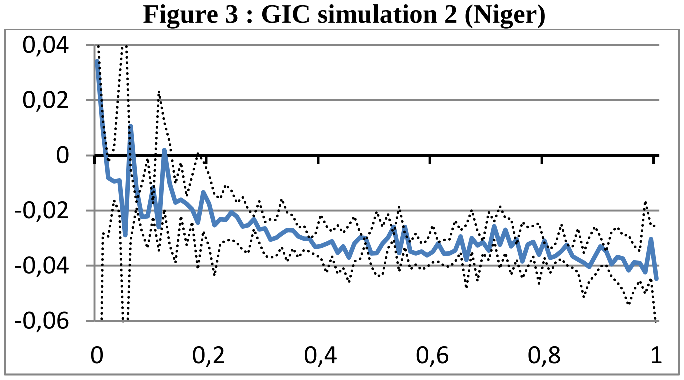


Figure 4 : GIC simulation 3a (Niger)

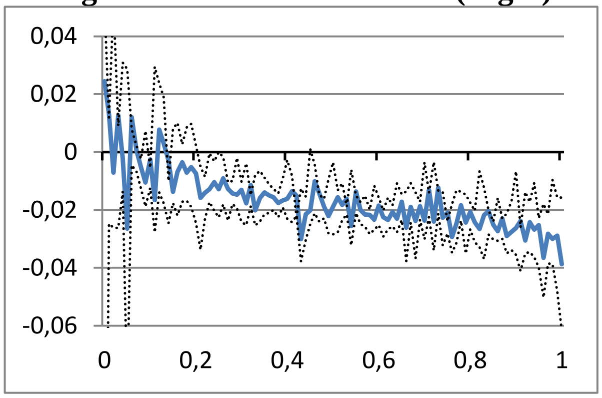


Figure 5 : GIC simulation 3b (Niger)

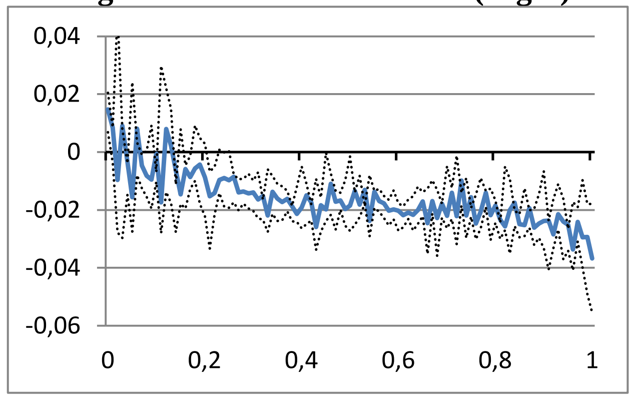


Figure 6 : GIC simulation 4a (Niger)

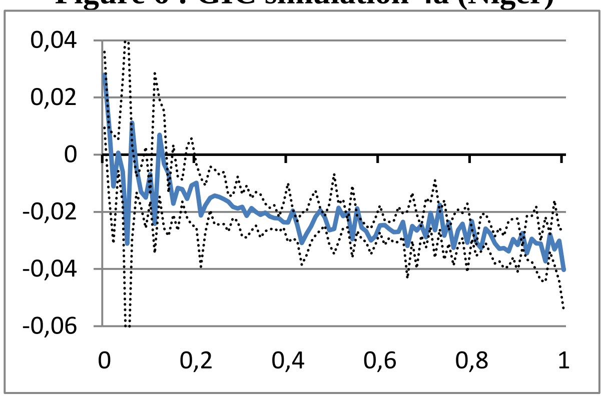
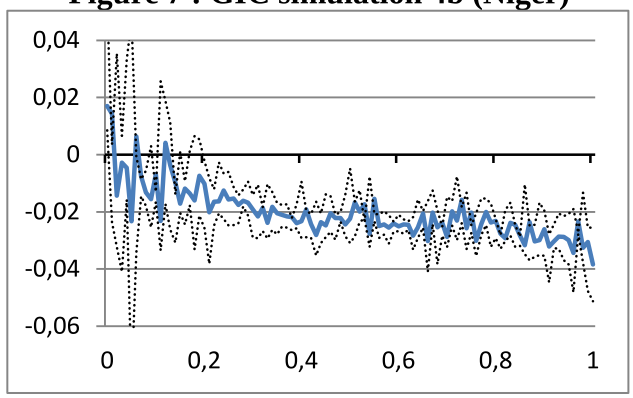


Figure 7 : GIC simulation 4b (Niger)



Source: Authors' calculations, results of the micro simulation on DASP

Decomposing by groups allows the identification of most vulnerable groups to changes in the VAT structure (Figure 8 to Figure 13). The changes in the distribution of income for the bottom percentiles are not significant. However, it is interesting to highlight that from the 20th percentile, there is a decrease of income for rural farmers. Let us recall that this group is the poorest and represents 63% of the total population of the country. The impact is not as strong when exemptions are maintained (Figure 10) or with the reduced rate of 5% (Figure 12). Whatever tax structure used, the urban non farmers are only weakly negatively affected (Figure 9, Figure 11, Figure 13).

Figure 8: GIC sim 2 rural farmers

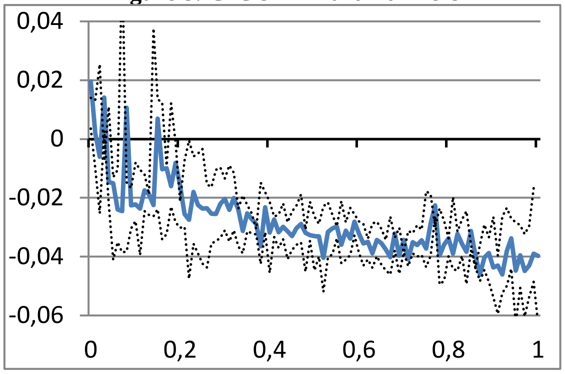


Figure 9: GIC sim 2 urban non farmers

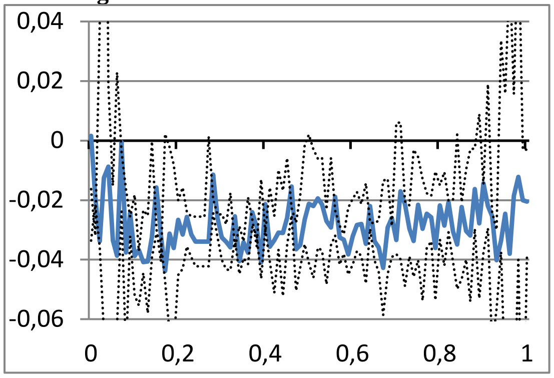


Figure 10: GIC sim 3b rural farmers

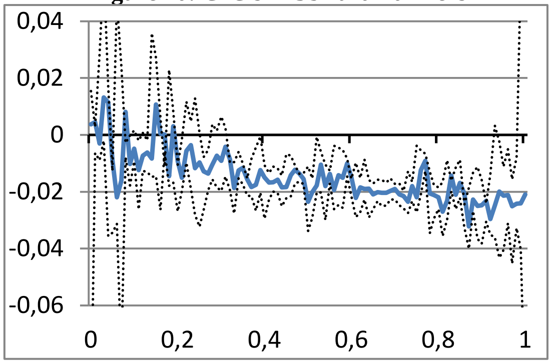


Figure 11: GIC sim 3b urban non farmers

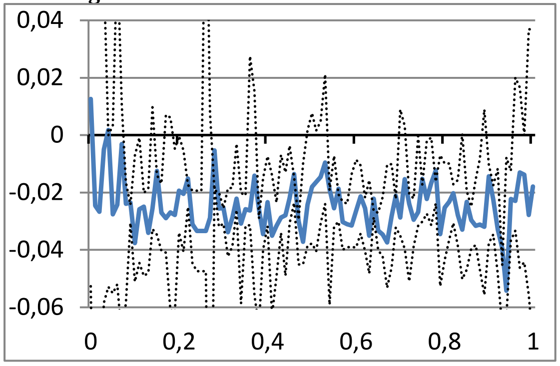


Figure 12 : GIC sim 4b rural farmers

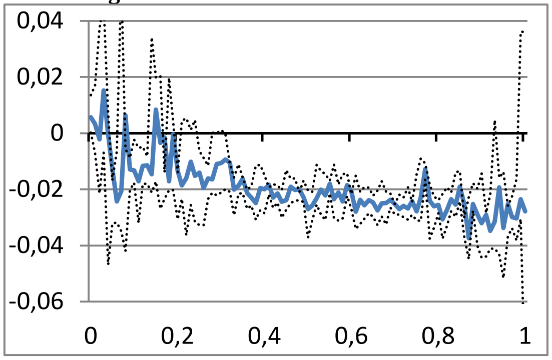
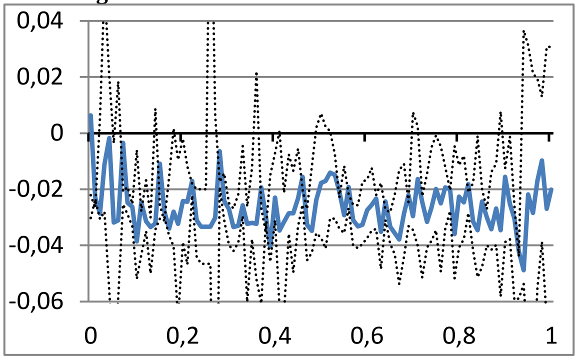


Figure 13: GIC sim 4b urban non farmers



Source: Authors' calculations, results of the micro simulation on DASP.

5. Concluding remarks

In this paper, we analyzed the distributional effects of broadening the tax base to exempted goods for various VAT designs in Niger. To do this, we built the first CGE Model combined with a micro simulation in order to perform a rich distributional analysis of VAT reforms taking into account that VAT is not a simple consumption tax in developing countries: the distributional impact of the end of exemptions depends on the net effect of the removal of the additional VAT tax burden supported by producers and the loss in domestic demand. Since most distributional analysis of VAT reforms are generally performed in partial equilibrium micro-simulation contexts, capturing the income and expenditure effects simultaneously is an important contribution of our application.

The economic and distributive impact of VAT reform in Niger provide interesting insight for developing countries with similar characteristics (*inter alia* Mali and Burkina-Faso) facing challenges to harmonize a fiscal system within an economic union such as WEAMU.
For a same level of tax income, the macroeconomic implications of broadening the VAT tax base with different structures produce different effects. For a nominal rate of 14% with exemptions on food staples allows sustaining the level of demand but does not allow supporting local production. Implementing a reduced rate of 5% on food staples and a full rate of 13% on other goods is more favorable to local production. The option where VAT credits supported by producers selling taxed goods at a reduced rate that are not reimbursed generate a reduction in GDP stronger compared to other simulations. Combining the broadening of the VAT to a reduction in the single rate from 19% to 9.5% is the option that increases the most tax revenues while minimizing the negative impact on GDP.

Designing the VAT structure most favorable to the poor requires taking into consideration the impact of broadening the tax base on the welfare of these poorest groups. We use a macro-micro modeling framework to achieve this analysis which allows us to capture simultaneously the income and price effects of such fiscal reform. Increases in government revenues by broadening the VAT tax base generate increases in poverty headcount index and the effects are stronger in urban areas compared to rural zones. However, when considering the depth and severity indices, farmers are the most negatively affected group. For a same level of government revenues, broadening the VAT tax base while maintaining agricultural goods and staple food exempted is the most favorable option for the poorest households. Nevertheless, under the budget neutrality hypothesis, poverty impacts are similar to the ones obtained with the single rate, VAT with exemptions and reduced VAT rates on food staples options. Inequality analysis with the Gini index revealed that if equity is an objective of the government, the unique VAT rate with broad base is the best option. The analysis of growth incidence curves revealed that for rural farmers, this policy option produces a weaker negative impact.

Our economic and distributional analysis of VAT reform in Niger provides useful insights for policy makers for optimal design of the reforms. The framework can also be very useful in targeting strategies. Moreover, we illustrate in our application that taking into account the specificities of VAT design in a developing country and capturing the income and price effects can generate rich distributional results in addition to the more macroeconomics effects of VAT reforms. For our further research agenda, we have undertaken an application in another country with the same framework.

6. References

Ahmad, E., & Stern, N. (1984) The Theory of Tax Reform and Indian Indirect Taxes. *Journal of Public Economics* 25:25998.

Ahmad, E., & Stern, N. (1991) *The Theory and Practice of Tax Reform in Developing Countries*. Cambridge University Press, Cambridge, U.K.

Annabi, N. (2003) Modeling Labor Markets in CGE Models: Endogenous Labor supply, Unions and Efficiency Wages. *Working Paper*, CIRPEE and Université Laval.

Armington, P. (1969) A Theory of Demand for Products Distinguished by Place of Production. Staff Papers. *International Monetary Fund* 16:159-176.

Atkinson, A. B., & Stiglitz, J. E. (1972) The Structure of Indirect Taxation and Economic Efficiency. *Journal of Public Economics* 1:97-1 19.

Auriol, E. & Warlters, M. (2005) Taxation base in developing countries. *Journal of Public Economics* 89(4): 625-646.

Ballard, C. L., Scholz, J. K., & Shoven, J.B. (1987) The Value Added Tax: A General Equilibrium Look at its Efficiency and Incidence. In *The Effects of Taxation on Capital Accumulation*, edited by M. Feldstein, 105–107. Chicago: University of Chicago Press.

Barlow, R. & Snyder, W. (1994) The Tax that Failed: The VAT in Niger. *Public Budgeting & Finance* 14:77-89.

Bird, R.M & Zolt, E.M. (2014) Redistribution via Taxation: The Limited Role of the Personal Income Tax in Developing Countries. *Annals of Economics and Finance* 15(2): 625-683.

Bird, R.M. (2014) Administrative Dimensions of Tax Reform, *Annals of Economics and Finance* 15(2): 963-992.

Boccanfuso, D., J.F. Cabral, F. Cissé, A. Diagne and L. Savard, (2007) " Un modèle de EGC-micro-simulations appliqué au Sénégal pour l'analyse de pauvreté et distribution de revenu " *l'Actualité économique : Revue d'analyse économique.* Vol. 83, no. 4 p. 447-495.

Boccanfuso, D. & Ménard, C. (2009) La croissance pro-pauvre : un aperçu exhaustif de la « boîte à outils », *Cahiers de recherche 09-06*, Département d'Economique de la Faculté d'administration, Université de Sherbrooke, Canada.

Boccanfuso, D., & Savard, L. **(**2011) The Food Crisis and its Impacts on Poverty in Senegal and Mali: Crossed Destinies. *Development Policy Review* 29(2):211–247.

Bourguignon, F., & Savard L. (2008) Distributional Effects of Trade Reform: An Integrated Macro-Micro Model Applied to the Philippines, in Bourguignon, F., L.A. Pereira da Silva and M. Bussolo, eds. "*The Impact of Macroeconomic Policies on Poverty and Income Distribution: Macro-Micro Evaluation Techniques and Tools*" Palgrave-Macmillan Publishers Limited, Houndmills. 177-212.

Bovenberg, A. L. (1987) Indirect Taxation in Developing Countries: A General Equilibrium Approach. Staff Papers. *International Monetary Fund* 34(2):333–373.

Burgess, R., & Stern, N. (1993) Taxation and Development. *Journal of Economic Literature* 31:762–830.

Chambas, G. (2005) TVA et Transition Fiscale en Afrique: Les Nouveaux Enjeux. *Afrique Contemporaine* 215(3):1–181.

Chen, S., & Ravallion, M. (2004) Welfare Impacts of China's Accession to the World Trade Organization. *The World Bank Economic Review* 18(1):29-57.

Clarete, R. L., & Whalley, J. (1987) Comparing the Marginal Welfare Costs of Commodity and Trade Taxes. *Journal of Public Economics* 33(3):357–362.

Cockburn, J. (2004) Trade Liberalisation and Poverty in Nepal: A Computable General Equilibrium Micro Simulation Analysis. *Development and Comp Systems* 0409012, EconWPA.

Cogneau D. & Robillard, A.S. (2000) Income Distribution, Poverty and Growth in Madagascar: Microsimulation in a General Equilibrium Framework. IFPRI Working paper 61/2000.

Creedy J. (2001) Indirect Tax Reform and the Role of Exemptions. *Fiscal Studies*, Institute for Fiscal Studies 22(4):457-486.

Decaluwe, B., Martens A., & Savard, L. (2001) *La Politique Économique du Développement.* Montréal: Université Francophone-Presse de l'Université de Montréal.

Devarajan, S., & Hossain, S.I. (1998) The Combined Incidence of Taxes and Public Expenditures in the Philippines. *World Development* 26(6):963–977.

Diamond, P. A. & Mirlees, J. A. (1971) Optimal Taxation and Public Production: I and II. *American Economic Review* 8–7:261–278.

Directive n°02/ 98/CM/UEMOA du 22 Décembre 1998 Portant Harmonisation des Législations des Etats Membres en Matière de TVA et n°03/98/CM/UEMOA sur les Droits d'Accise.

Dorosh, P., & Essama Nssah, B. (1991) A Social Accounting Matrix for Niger: Methodology and Results. Working Paper 18. Ithaca, NY: Cornell Food and Nutrition Policy Program.

Ebrill, L., M. Keen, Bodin J.P., & Summer, V. (2001) *The Modern VAT*. Washington, DC: International Monetary Fund.

Emini, C. A. (2000) Analyse de L'incidence d'une TVA Imparfaite à L'aide d'un Modèle Calculable d'Equilibre Général: Application au cas Camerounais. CREFA Research Paper 00/06, Université de Laval, Québec, Canada.

Filmer, D. & Pritchett, L. (1999) The Effect of Household Wealth on Educational Attainment: Evidence from 35 Countries, *Population and Development Review*, The Population Council, Inc. 25(1): 85-120.

Filmer, D., Hammer, J. & Pritchett, L. (2000) Weak Links in the Chain: A Diagnosis of Health Policy in Poor Countries, *World Bank Research Observer*, World Bank Group 15(2): 199-224.

Foster, J., Greer, J., & Thorbecke, T. (1984) A Class of Decomposable Poverty Measures. *Econometrica* 52(3):761–66.

Gauthier, B. & Wane, W. (2007) Leakage of public resources in the health sector: an empirical investigation of Chad, Policy *Research Working Paper Series 4351*, The World Bank, Washington DC.

Gautier, J. F. (2001) Taxation Optimale et Réformes Fiscales dans les PED: Une Revue de Littérature Tropicalisée. *DIAL*. Research Paper 2001/02.

Gautier, J. F. (1999) Les Paradoxes de la TVA dans un pays en Développement: L'illustration de L'industrie Malgache. *Tiers-Monde* 40(157):187–211.

Giesecke, J. A., & Nhi, T.H. (2010) Modeling Value-added Tax in the Presence of Multi-production and Differentiated Exemptions. *Journal of Asian Economics* 21(2):156–173.

Gottfried, P. & Wiegard, W. (1991) Exemption Versus Zero Rating: A Hidden Problem of VAT. *Journal of Public Economics* 46:307–328.

Hossain, M. S. (2003) Poverty and Social Impact Analysis: A Suggested Framework. *International Monetary Fund*,Working paper WP/03/232.

Hossain, S. M. (1995) The Equity Impact of the Value Added tax in Bangladesh. Staff Paper, *International Monetary Fund* 42(2):411–430.

INS, Ministère de L'économie et des Finances, Niger. (2008). L'analyse de la Politique Fiscale au Niger et ses Impacts sur la Pauvreté.

INS, Niger. (2006) *Questionnaire des Indicateur de Base du Bien-être* (QUIBB_2005), Profil de Pauvreté.

Jenkins, G. P., Jenkins H. P., & Kuo, C.Y. (2006) Is the Value Added Tax Naturally Progressive? *Queen's Economics Department.* Working paper 1059.

Keen, M. (2007) VAT Attacks! *International Tax and Public Finance* 14:365–381.

Lauré, M. (1957) *Traité de politique fiscale*, PUF, p.425

Mackenzie, G. A. (1992) Estimating the Base of the Value-added Tax (VAT) in Developing Countries: The Problem of Exemptions. *Public Finance* 47:257–270.

Munk, K. J. (2007) Tax-tariff Reform with Costs of Tax Administration. *International Tax and Public Finance* 15:647–667.

Munoz S. & Cho S. (2003) Social Impact of Tax Reform: The Case of Ethiopia. *International Monetary Fund*. Working paper 03/232 November.

Ramsey F.P. (1927) A Contribution to the Theory of Taxation, *The Economic Journal* 37(145): 47-61.

Ravallion, M. & Chen, S. (2003) Measuring pro-poor growth, *Economics letters* 78(1): 93-99.

Robillard, A. S., Bourguignon, F., & Robinson, S. (2001) Crisis and Income Distribution: A Micro-macro Model for Indonesia. Paper presented at the OECD Development Center Conference, December 9–10, Paris, France.

Sadka, E. (1977) A Theorem on Uniform Taxation. *Journal of Public Economics.* 7:387–391.

Sahn, D. E., Dorosh, P. A., &. Younger, S.D. (1999) *Structural Adjustment Reconsidered: Economic Policy and Poverty in Africa.* Cambridge, U.K.: Cambridge University Press.

Sandmo, A. (1974) A Note on the Structure of Indirect Taxation. *American Economic Review* 701–706.

Sandmo, A. (1976) Optimal Taxation: An Introduction to the Literature. *Journal of Public Economics* 6:37–54.

Savard, L. (2003) Poverty and Income Distribution in a General Equilibrium Model: Top Down/Bottom Up Approach. CIRPEE Centre Inter-univeristaire sur le Risque, les Politiques Economique et L'emploi. Working paper 03-43.

Savard, L. (2005) Poverty and Inequality Analysis Within a CGE Framework: A Comparative Analysis of the Representative Agent and Micro Simulation Approaches. *Development Policy Review* 23(3):313–331.

Serra-Puche, J. (1984) A General Equilibrium Model for the Mexican Economy. In *Applied General-equilibrium Analysis* edited by H. E. Scarf and J. B. Shoven, 447–482. Cambridge, U.K.: Cambridge University Press.

Shome, P. (1995) *Tax Policy Handbook.* Washington, D.C.: International Monetary Fund.

Shoven, J. B., & Whalley, J. (1977) Equal Yield Tax Alternatives: General Equilibrium Computational Techniques. *Journal of Public Economics* 8(2):211–224.

Shoven, J. B., & Whalley, J. (1984) Applied General-Equilibrium Models of Taxation and International Trade: An Introduction and Survey. *Journal of Economic Literature* 22(3):1007–1051.

Tait, A. A. (1988) *Value-added Tax: International Practice and Problems.* Washington DC: International Monetary Fund.

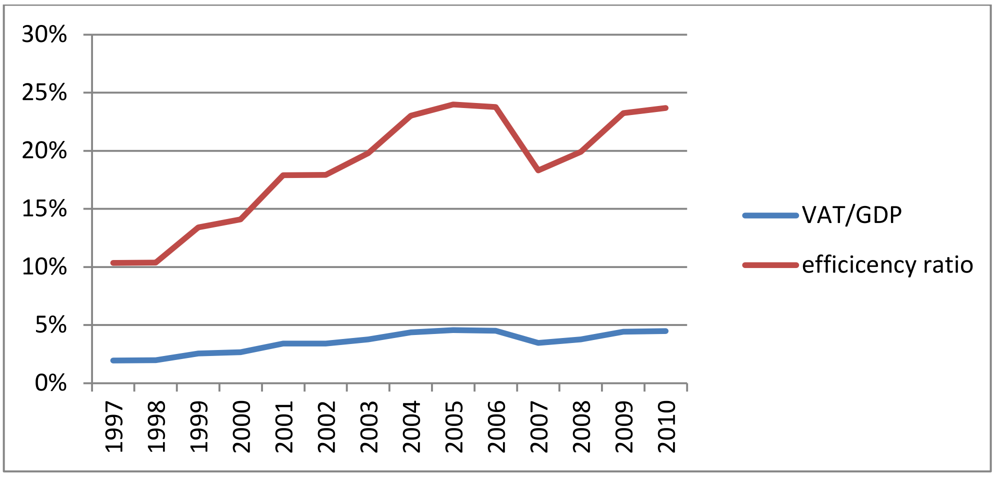
Tanzi, V., & Zee, H. H. (2000) Tax Policy for Emerging Markets: Developing Countries. *International Monetary Fund*. Working paper 00/35:34.

Toh, M., & Lin, Q. (2005) An Evaluation of the 1994 Tax Reform in China Using a General Equilibrium Model. *China Economic Review* 16(3):246–270.

UEMOA. (2008) L'évaluation de L'application des Directives de l'UEMOA, Portant Harmonisation des Législations des Etats Membres en Matière de Taxe sur la Valeur Ajoutée et de Droits D'accises. UEMOA.

Zafar, A. (2005) Revenue and the Fiscal Impact of Liberalization: The Case of Niger. World Bank Policy Research. Working paper 3500:27.

Appendix A: VAT System in Niger, 1997–2010



Local Administrations

Appendix B: Presentation of the Aggregated Sectors

Agriculture	Un-irrigated food crop agriculture, irrigated food crop agriculture, un-irrigated export agriculture, irrigated export agriculture
Livestock	Livestock, forestry, fishing
Food processing	Industrial foods, beverages
Industry	Mining, textiles and clothing, chemical industry, production of metals, other manufacturing, electricity, gas and water, construction
Private Services	Transport and communications, financial services, real estate and business services, hotels and restaurants, other services
Public Services	Public administration, education, health, and social services, community and personal services

Appendix C: Value-added Tax Statistics Considering Model Calibration

	Effective VAT Rate	Distribution of Collected VAT	VAT Supported by Sectors % of production value
Agriculture	1,2	8,89	0,12
Livestock	0,01	0,44	0,03
Agribusiness	2,59	10,4	0,85
Industry	10,52	59,91	4,26
Private Services	2,47	20,35	1,17

Data drawn from 2004 SAM and our modeling hypothesis of the VAT. Values are presented in percentages.

Appendix D: Elasticities Used in a Model

	Agriculture	Livestock	Agribusiness	Industry	Services	Public Services
Sigmar	0,98	1,07	1,07	0,56	1,33	1,06
Sigmal	1,2	1,2	1,2	1,2	1,2	
Sigmava	0,8	0,8	0,8	0,8	0,8	0,8
Sigmam	1,3	1,3	1,3	0,8	1,3	
Sigamae	1,2	1,2	1,2	1,1	1,3	

Sigmar: Revenu Elasticity (econometric estimation on the households data) ; Sigmava: Elasticity of substitution between labor and capital. Sigmal : Elasticity of substitution between qualified and non-qualified labor; Sigmam: Armington elasticity. Sigmae: elasticity of transformation of the CET for exports; Frisch Parameter: -5.85 (Annabi et al, 2003).

Appendix E: Economic Sectors of Niger (%)

	Agriculture	Livestock	Agribusiness	Industry	Services	Public Services
Mi/Qi	14,86	0,35	17,08	61,63	0,67	0,00
Mi/M	13,67	0,19	9,15	76,31	0,69	0,00
EXi/XSi	7,89	16,83	0,99	42,85	0,61	0,00
EXi/EX	12,99	21,54	0,79	63,28	1,40	0,00
VAi/VA	21,93	17,21	5,40	14,68	28,97	11,81
VAi/XSi	76,89	77,67	38,74	57,41	72,98	70,97
XSi/XS	19,46	15,12	9,51	17,46	27,09	11,35
LQi/LQ	0,00	0,00	1,86	17,12	12,00	69,02
LNQi/LNQ	24,64	19,27	6,22	15,05	30,65	4,17
KDi/KD	28,44	23,32	1,12	4,61	39,70	2,80
LQi/VAi	0,00	0,00	4,10	13,87	4,93	69,54
LNQi/VAi	92,37	92,03	94,67	84,28	87,00	29,06
LDi/VAi	92,37	92,03	98,78	98,15	91,93	98,60
KDi/VAi	7,63	7,97	1,22	1,85	8,07	1,40

I: sectors; Mi: imports; EXi: exports; Qi: quantity of available goods in the economy; VAi: value added; XSi: production. LQi: Qualified Labour; LNQi: Non-qualified Labour; KDi: Capital demand; Authors' calculations, SAM 2004 data.

Appendix F: Price Variations for Each Simulation

			% of variations						
Variables	Sectors	Baseline	Sim1	Sim2	Sim3a	Sim3b	Sim4a	Sim4b	Sim5
Consumption Price (PC)	Agriculture	1.06	9.63	5.64	-0.03	0.02	2.26	2.35	2.40
	Livestock	1.02	9.78	6.70	8.05	8.70	7.67	8.67	7.90
	Food processing	1.09	10.87	4.92	7.14	0.63	6.29	0.47	3.67
	Industry	1.22	6.78	-0.98	1.17	2.51	0.40	1.95	1.64
	Services	1.03	9.37	4.64	6.31	7.34	5.77	7.08	6.44
	Public Services	1.00	-1.06	-0.34	-0.35	-0.35	-0.34	-0.34	-0.43
Composite Price (PQ)	Agriculture	1.04	-6.38	-2.05	0.54	0.46	-1.02	-0.94	-0.89
	Livestock	1.02	-7.63	-2.53	-3.57	-4.36	-3.05	-3.63	-4.31
	Food processing	1.06	-4.31	-1.69	-1.92	1.36	-1.82	-1.73	1.40
	Industry	1.11	-1.38	-0.71	-0.89	-1.00	-0.77	-0.75	-1.05
	Services	1.00	-5.49	-1.82	-2.55	-3.00	-2.18	-2.46	-3.04
	Public Services	1.00	-1.06	-0.34	-0.35	-0.35	-0.34	-0.34	-0.43
Domestic Price (PD)	Agriculture	1.00	-7.57	-2.44	0.65	0.55	-1.22	-1.12	-1.06
	Livestock	1.01	-7.66	-2.53	-3.58	-4.38	-3.06	-3.64	-4.33
	Food processing	1.00	-5.40	-2.12	-2.42	1.72	-2.29	-2.17	1.77
	Industry	1.01	-3.70	-1.91	-2.39	-2.67	-2.06	-2.01	-2.82
	Services	1.00	-5.51	-1.83	-2.57	-3.02	-2.19	-2.48	-3.06
	Public Services	1.00	-1.06	-0.34	-0.35	-0.35	-0.34	-0.34	-0.43
Producer Price (PP)	Agriculture	1.00	-6.97	-2.25	0.60	0.50	-1.13	-1.04	-0.98
	Livestock	1.00	-6.41	-2.13	-3.01	-3.68	-2.58	-3.06	-3.64
	Food processing	1.00	-5.35	-2.10	-2.39	1.70	-2.27	-2.15	1.76
	Industry	1.00	-2.17	-1.12	-1.40	-1.57	-1.21	-1.18	-1.65
	Services	1.00	-5.48	-1.82	-2.55	-3.00	-2.18	-2.46	-3.04
	Public Services	1.00	-1.06	-0.34	-0.35	-0.35	-0.34	-0.34	-0.43
Value Added Price (PVA)	Agriculture	0.99	-3.95	-0.21	-0.82	-1.19	-0.46	-0.55	-1.42
	Livestock	0.99	-3.38	-0.02	-0.61	-0.96	-0.28	-0.35	-1.16
	Food processing	0.99	-2.80	0.24	-0.34	-0.70	-0.01	-0.09	-0.85
	Industry	1.03	-0.52	1.21	0.67	0.33	0.97	0.87	0.34
	Services	1.00	-3.25	0.10	-0.51	-0.87	-0.17	-0.26	-1.05
	Public Services	1.00	0.01	0.08	0.26	0.38	0.17	0.23	0.29

CGEM results with 2004 SAM, considering the authors' hypotheses.

Appendix G: Nominal changes of Gini inequality for each simulation (%)

	Sim1	Sim2	Sim3a	Sim3b	Sim4a	Sim4b	Sim5
Niger	-0.32**	-0.25**	-0.18**	-0.18**	-0.22**	-0.22**	-0.23**
Uagr	-0.26	-0.17	-0.09	-0.13	-0.12	-0.15	-0.15
Ragr	-0.74**	-0.47**	-0.17**	-0.16**	-0.29**	-0.26**	-0.33**
Unagr	0.28*	0.05**	0.09**	0.00	0.07**	-0.01	0.04
Rnagr	-0.62**	-0.42**	-0.26**	-0.23**	-0.32**	-0.30**	-0.34**

Authors' calculations. Results of the micro simulation on DASP. *Significance threshold of 10%.**Significance threshold of 5%.