Can the removal of VAT Exemptions support the Poor?

The Case of Niger

Céline de Quatrebarbes**

Luc Savard*

Dorothée Boccanfuso*

Abstract:

In order to have the public funds necessary for its development, Niger is examining the possibility of broadening its Value- added tax (VAT) base to exempted goods and basic food products. This proposal has prompted violent opposition leading to the question of the social impacts of taxation. The question whether indirect taxes should be uniform or differentiated has already received a lot of attention in the literature but only the consumer's consideration used to taking into account. Due to public administration inefficiencies, VAT can also become a production tax and not only a tax on consumption. This new approach can change the usual conclusion about the optimal VAT design. The first micro-macro computable general equilibrium model of Niger's actual economy has been developed to answer these questions. The model's results show that although restoring the VAT rate would be socially costly compared to the initial situation, the distributional impact of the VAT differs according to the system implemented in the country. First of all the multiple rates VAT design can only be socially preferable compared to a single rate if VAT credits are refunded. In addition, associating the preservation of VAT exemptions in the food crop agriculture sector with a tax base expansion in the remaining sectors turns out to be the best option in Niger. Indeed it will increase public revenue while taking into account the national goal of poverty reduction.

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Key Words: Computable general equilibrium model, micro-simulation, Value Added Tax, exemptions, distributional analysis, Niger.

*GREDI, Department of Economics Business Faculty Université de Sherbrooke, Sherbrooke, Canada

**CERDI, Centre d'Etudes et de Recherche sur le Développement International, Université d'Auvergne Clermont 1, http://www.cerdi.org/, Clermont Ferrand, France

**corresponding author: Céline de Quatrebarbes. E-mail :celine.dequatrebarbes@gmail.com.

Introduction

Niger has reinforced its value-added tax (VAT) system in view of successfully completing its fiscal transition and mobilizing resources required for its development. According to the available statistics (UEMOA, 2008), Niger nonetheless remains one of the WAEMU countries with the lowest overall public tax collection rates.[1] In 2009 Niger had a tax pressure rate of 13.9% and an average of 10.1% from 1998 to 2005 which is lower than the average of 14.08% of the GDP over the same period in the WAEMU.[2] In 2005, the VAT revenues were roughly 5% of the GDP, one of the lowest tax ratios in Africa. The VAT efficiency ratio constructed by Ebrill and Keen (2001) [3] gives an average of 27% for Sub-Saharan African countries and 24% for Niger in 2005. It varies between 23% and 36% for the other WAEMU countries, except for Togo (45%) and Senegal (61%) that have a much better performance.

Faced with this situation and in view of improving the returns of the internal indirect tax, the Nigerien government has tried to reduce VAT exemptions by extending the tax base to include basic food products. Exemption of these consumer goods indeed yields significant tax loss. Food crop agriculture represents an important share of transactions in the country but are often exempted or exchanged in the under-taxed traditional sector. Besides, as well as an increase in public revenue, the end of VAT exemptions should restore economic efficiency.

Nonetheless it's important to assess the social impacts of the removal of VAT exemptions and to understand whether reinforcing public revenues might hamper national and international efforts made to reduce poverty. Indeed, the relation existing between the increase in public revenues and the establishment of effective poverty reduction programs is not always confirmed in the short term (Filmer et al., 1998; Gauthier, 2007). This enables the hypothesis that the social objectives of the country should be taken into account right from the definition of the characteristics of public tax collection. In a country where 62.1% of the population lives below the poverty line (QUIBB_ 2005) and 34% in extreme poverty, where subsidies targeted at the level of household income are nearly inexistent, taxation can constitute an instrument to fight poverty. Under this hypothesis, it is important to analyze the impact of the end of exemptions in an economy like Niger and define

[1] It is important to remember, however, that current comparison in terms of level of tax collection between WAEMU countries is somewhat biased by the lack of harmonization of ways to calculate the level of fiscal pressure. The rate of fiscal pressure is generally calculated by the relation between total tax revenues and the GDP, but the difference is due to the composition of the numerator.

[2] Niger, Finance Department, National Institute of Statistic, (2008) Report : « L'analyse de la politique fiscale au Niger et ses impacts sur la pauvreté ».

[3] Ebrill and Keen (2001) have advanced efficiency differences of the VAT according to the economic and social structures of countries and have attempted to classify the countries and regions of the world according to VAT efficiency. The traditional measure is the "efficiency ratio"—the ratio of VAT revenues to the GDP divided by the standard VAT rate, that is, the single rate normally applied over all products. The efficiency ratio of a VAT system with satisfactory functioning is situated between 40% and 50%.

in what way a VAT design could support the poor.

Even if value added tax has been analyzed in multiple manners with various technical instruments, the debate concerning the optimal VAT design is still relevant today. Whereas literature is usually focused on the consumer's point of view it is also important to take into account the fact that in developing countries like Niger, VAT can easily become a production tax as well as a consumption tax (Chambas, 2005) due to VAT exemptions but also due to public administration inefficiency. The poverty indicators are a function of both production and access to goods and services. This study goes beyond the representative agent hypothesis by using a micro-simulation computable general equilibrium model (MS-CGE) representing the Nigerien economy (such as proposed in Chen and Ravaillon 2004)).

This paper is split up into four sections. In the first, we present the characteristics of the VAT structure in Niger, some assumptions about the social incidence of the end of VAT exemptions and in what way VAT design could support the poor. The micro macro CGE model is presented in the second section. The third focuses on the definition of the VAT scenarios and the analysis of the aforesaid scenario's simulation. In the last section, we make some concluding comments.

1. The Nigerien choices regarding internal indirect taxation structure:

a. An imperfect VAT design regardless to the theory:

The VAT was introduced in Niger on January 1, 1986. At the beginning, there were three VAT rates: 35%, 25%, and 15%. In 1994, these rates respectively became 24%, 17%, and 10%. In 1990, four years after the implementation of the VAT, comparable collection had decrease by more than 40%. This decline cannot be explained by movement in GDP which increased but by the importance of transactions exempted from VAT. Since 1998, Niger has had to conform to WAEMU directives regarding indirect taxation:[4] choosing a single VAT rate ranging from 15% to 20%, harmonizing taxable goods and exemptions, possibly applying the VAT to the agricultural sector, and excluding transport activities. Starting in January 2000, Niger thus implemented a single-rate VAT of 17%. In May 2000, with the establishment of the Common External Tariff and the expected decrease in customs revenues, the VAT rate climbed to 18% then to 19% in 2002.

The VAT has to be neutral in economic decisions without taxing input. The producer remits to the government the difference between the tax paid by the buyer and the VAT paid on his own inputs. Producer retains the rest to offset the taxes paid on the inputs (Ebrill and al., 2001). The

[4] Directives No. 02/98CM/UEMOA on VAT and No. 03/98/CM/UEMOA on excise duties.

imperfections of the Nigerien VAT system are numerous compared to a "pure" VAT as prescribed by economic theory mainly due to the share of legal exemptions and illegal tax evasion. Between 2003 and 2005, legal exemptions in Niger represented on average more than 43% of the internal VAT yields. The government exempts some strategic goods or activities to promote them. It does not concern only commodities consumed by poor populations but increasingly extends to the industrial sector (mines and agro-food industry) or services for a more or less lengthy period. In rural areas, the VAT base represents only 43.1% of total expenditure and 48.6% of the total consumption Niamey households' mainly due to the existence of the informal sector.[5]

Exemptions occur when output is untaxed and also when the tax paid on inputs is not recoverable, it creates a break in the chain of VAT credit implying that producers have to pay the tax and not final consumer (directly). There is also a competition between exempted goods and taxed items and the presence of a cascade effect in the production chain. They decrease the consumer price for the exempted item which benefits the final consumer and indirectly poverty indices but increase production costs. The only way for the producer to remain neutral when faced with VAT exemptions would be to transfer this additional tax burden to the consumer by raising prices.

By creating distortion in the production chain, between sectors and between goods, VAT exemption is theoretically costly in term of economics' efficiency. The removal of legal exemptions and evasion should improve resources allocations and may generate a reduction in poverty. Indeed, additional tax burden for the producer will have indirect impact on poverty levels given the additional cost for producers and hence a decrease in private sector revenues. Nonetheless, the suppression of exemptions can have an ambiguous effect in terms of poverty, as the latter very sensitive to the cost of the consumption basket for low income households. The net impact of the end of exemption is *a priori* difficult to determine.

b. Uniform VAT rate versus multiple VAT rates:

The end of exemption forces the government to choose a new VAT design: a uniform rate close to a pure VAT system or the introduction of a reduce rate on large consumption goods. The WAEMU have chosen the first one. Even if value added tax has been analyzed in multiple manners with various techniques, the debate on optimal VAT design is still relevant today (Keen, 2007). The question whether indirect taxes should be uniform or differentiated has already

[5] 1999 survey on households consumption and data from the department of Finance, Niger National Institute of Statistic, (2008) Report « L'analyse de la politique fiscale au Niger et ses impacts sur la pauvreté ».

received a lot of attention in the literature, especially in the early years following the breakthrough of optimal tax theory (Atkinson and Stiglitz (1972, 1976), Sandmo (1974, 1976), and Sadka (1977)). The mains arguments have been summarized by Gautier (2001). The theoretical goal of a single-rate VAT system is not a high rate but the largest possible tax base, thus distributing the tax burden over the economy while favouring optimal budget performance and avoiding competition between goods. A reduce VAT rate should take into account the national goal of poverty reduction by increasing the purchasing power of poor households but the distributional impact also depends on the national structure of the demand. The establishment of a reduced rate on a few sensitive items could provide a way to avoid multiplying *ad hoc* or permanent exemptions while avoiding penalizing the consumers of these products with a full tax rate. It should also be more progressive than the uniform rate. Indeed, in a uniform tax system, poor households could pay a higher proportion of tax with respect to their income. Very little empirical have been performed to see if the actual value added taxes paid on the goods and services consumed by households confirms or rejects these hypothesis. Ahmad and Stern (1984, 1987) conclude that multiple VAT rates or a uniform VAT system with exemptions is more progressive; Jenkins and al. (2006) shows that the existence of the under tax sector improves the VAT's progressivity. Alderman (2002) underlines that the progressivity of this type of measure is still limited compared to subsidies. Indeed, exemptions or reduce VAT rate applies to a good and is not targeted at a specific group in the population.

Nonetheless, most of the studies only analyze the consumer's point of view without taking into account the administrative difficulties in developing countries which influence the producer's situation (Chambas, 2005). The weakness of administrative capacities for tax collection and management is well known in developing countries (Shome, 1995; Tanzi et Zee, 2000). It could promote tax avoidance but also implies that sometimes VAT credits cannot be refunded. The most famous example in Niger is the export firm situation[6]. The zero VAT rate is not effective and induce cascade effects on export producers. In this case, the VAT has functioned largely as a tax on exports (Bonjean and Chambas, 2001; Gottfried, P. and W. Wiegard, 1991). The social impact of each VAT system depends on the ability of the Nigerien's tax authorities to control and reimburse VAT credits. The multiple rates can create VAT credits for firms when a part of the inputs is taxed at the full rate and the final product, at a reduced rate. The administrative problems could create a break in the chain of VAT credits. In this case VAT is both

[6] Report*: l'évaluation de l'application des directives de l'UEMOA, portant harmonisation des législations des États membres en matière de taxe sur la valeur ajoutée et de droits d'accises.*

consumption and production tax. Producers' situation could thus be close to an exemption situation and it could also lead to a slow-down in the production system. In these developing countries context, it's hard to say which VAT design could support the poor.

2. A computable general equilibrium model to study the social impact of expanding the tax base

The results of the social incidence of VAT designs differ between partial equilibrium and general equilibrium model. General equilibrium model (CGEM) takes into account substitutions between goods and the VAT cascade effects on relative prices (Devarajan and Hossain, 1998). CGEM have often been used to evaluate the macroeconomic impact of a tax reform (Shoven and Whalley, 1984; Shoven and al.1987; Burgess and Stern, 1993). The introduction of the VAT in specific countries has often been analyzed (Toh and al. 2005) especially in the fiscal transition case (Clarete and Whalley, 1987; Cockburn, 2004). Ballard, Scholz and Shoven (1987) have analysed welfare effects of adopting different VAT systems for the US. There is no VAT in their baseline scenario. The analysed reforms include a uniform VAT and a differentiated VAT system. They found that rate differentiation produces a less regressive distribution of welfare gains and losses than those of a uniform VAT. Nonetheless VAT is conceptualized as a uniform consumption tax as in Serra-Puche (1984), Ballard and al. (1987) even though it is not always the case (Keen, 2001; Chambas, 2005). Bovenberg (1987), Emini (2000) and Giesecke and Nhi (2010) have analyzed the possibility of moving away from a uniform taxation rate by multiplying rates and the possibility to exempt goods. Nonetheless, they have not taken into account administrative difficulties. We propose the first study that integrates the complexity of VAT application in a distributional analysis of different VAT design.

The CGE model takes into account imperfections of VAT application by starting with the initial situation of VAT exemptions in certain sectors of the Nigerien economy. It also aims to compare the social impact of different VAT design ranging from a single-rate to multiple-rates and to the preservation of certain exemptions on agricultural goods. We have analyzed the impact of the administrative efficiency by considering VAT as a consumption tax but also in some simulations, as a production tax. We further investigate the impact of these changes on poverty and inequalities indices while taking into account heterogeneity in the structure of household incomes and expenses.

a. Nigerien data

The model uses data from a social accounting matrix (SAM) of the Niger economy for 2004 and from a household survey *Questionnaire unifié des Indicateurs de base du bien-être* (QUIBB) for 2005. The information on Nigerien tax structure is provided by the country's fiscal office for the year 2006.

The SAM has been aggregated to cover four sectors: food crop agriculture, export agriculture, industry[7] and services. The aggregation of the SAM provides a way to make up for the weakness in tax information. The distinction between food crop agriculture and export agriculture offers a way to take into account specific characteristics of these two agricultural sectors a primarily informal part of agriculture, an under-taxed locally consumed, and a primarily exported form of agriculture.

Primary sector production is predominant in Niger. Agricultural production, including export agriculture and food crop agriculture, represents 43.9% of national value added. Services constitutes 30.4% of the country's total value added, followed by industry with 25.71%. Extraction industries with the mining sector of gold and uranium, produces 9% of total value added. Agriculture has a high value added rate, respectively 87.9% for non-exporting food crop agriculture and 87.20% for export agriculture, based on the weak use of inputs. Trade with the rest of the world is concentrated in the industry sector (68.6% of exports and 85.8% of imports). Export agriculture represents 31.4% of exports and food crop agriculture, 4.7% of imports. The penetration rate of imports in the country is 24.6% and these imports are foremost made up of industrial goods, but available goods on the territory are nevertheless mostly locally produced. The labour factor receives the largest share of value added, primarily from the agricultural sectors.

According to the information from the SAM, it can be seen that the level of VAT collected is roughly 22% of the sum of payable VAT when considering a pure VAT at a 19% rate applied only on final consumption, representing a little less than 5% of GDP and 37% of total tax revenues, which is consistent with the aggregate statistics of the government. The VAT levied on custom duties represents 60% of total VAT revenues. The average effective VAT rate is thus significantly below the official VAT rate, the difference being due to two factors: the high proportion of VAT exemptions and tax evasion. The informal sector (mainly agriculture and trade) constitutes 70 to 80% of traded GDP. Most of VAT revenues come from the taxation of industrial goods. As for taxes on foreign trade, the sectors most affected are chemical, oil, and

[7] This sector includes the mining industry, food and beverage production, textile and clothing production, the chemical industry, metal production, other factories, electricity, gas, water, and finally construction.

manufactured products. Direct taxes do not concern the entire population and the tax burden especially concerns the workers in the formal private and public sectors. Individual entrepreneurs in the informal sector also pay a direct tax (lump sum tax), although the sum of these revenues is low for the government. (Data on the structure of the Nigerien economy based on the SAM are presented in Appendix 1.)

b. Characteristics of the computable general equilibrium model

The EXTER model of (Decaluwé and al, 2001) was used as a starting point. It has been modified to take into account the specificities of the Nigerien economy and is applied to the SAM structure just presented. Each sector produces a single good. As a result, there is the same number of goods produced as there are production sectors, with the addition of oil, which is consumed but not locally produced. Only the "export agriculture" and "industry" sectors take part in international trade. The "trade", "service", and "food crop agriculture" sectors are non-tradable.

The production technology is represented by constant return to scale which combines labour and capital. We assume an exogenous labour supply and labour is mobile while capital is fixed. The fixity of capital can be explained in Niger by the weak development of financial markets and the difficulty of transforming capital in the short- to medium-term. Hence, the model considers the short-to medium term influences of a tax policy. The level of intermediate consumption is linked to production by fixed technical coefficients. The functional form describing the level of value added is a production function with a constant substitution elasticity taking into account labour/capital substitution. Producers in each sector maximize profits subjected to their technology constraint and determine optimal factor's demand.

The Armington (1969) assumption is used to distinguish imports and domestically produced goods, implying imperfect substitutability and to differentiate exports from goods for domestic use. The production possibility frontier of the economy is defined by a constant elasticity of transformation (CET) function between domestic supply and export and this yields the export supply function. The model defines a composite commodity made up of domestic demands and final imports, which is consumed by households, firms and the government. We assume a constant elasticity of substitution (CES) function between domestic demand and final imported demand and this provides the import demand function. Import and locally produced goods are subject to the same taxation structure. The parameters of CES and CET functions are exogenously determined.

Households receive income from primary factor payments that they hold directly, transfers from

government and from the rest of the world. Households spend in the consumption of goods and services, pay taxation, and saved. Household demands are represented by a linear expenditure system (LES) derived from the maximization of a Stone-Geary utility function[8]. The analysis of the distributional impact of tax reform is complemented by a micro-simulation model.

Government revenues are generated of all levied taxes, i.e. direct taxes, production taxes, import duties, export duties, and indirect internal taxes (VAT and excise duties), as well as foreign aid and remittances from the rest of the world. As for their tax component, revenues depend on tax rates but also on the variation of their tax base. International transfers to the government are exogenous. The government produces public services, consumes various goods, and remunerates civil servants. Government savings are residual and correspond to government revenue from which are subtracted public expenditures and transfers from government to Nigerien households.

Prices are modelled in standard fashion. Nevertheless, this work highlights a few specificities of our modelling of prices such as the market price of goods and services. We will detail VAT treatment further on.

The equilibrium conditions and closure of the model are traditional. For each market, equilibrium is ensured by a price mechanism that endogenously adjusts the supply and demand. Investment is determined by the level of savings of agents. Household savings and public savings, for their part, are residual and endogenous. The nominal exchange rate is chosen as numeraire; transfers between the various agents and foreign saving are exogenous and fixed to their initial values. The current account balance is exogenous and balances out with adjustment of the real exchange rate. Public expenditure is fixed, which is easily explained in a developing country such as Niger[9] and corresponds to our analytical framework distinguishing the effect of an increase in public revenues and the establishment of an effective policy for poverty reduction.

c. Specificities in the treatment of internal indirect taxation

The value added tax is an *ad valorem* tax, which applies to the price of the composite good (locally produced and imported goods). The imperfections of VAT application: exemption and VAT credits are modelled as a supplementary tax paid by the producer during the purchase of intermediate consumptions goods. In both cases producers have to support VAT paid on their input. We have consequently modelled two types of VAT rates: the first one is applied on the composite price of intermediate consumptions when the final good is exempted or when VAT

[8] The Stone Geary function presupposes that consumer's preferences are homothetic.
[9] Between 1999 and 2005, government spending remained stable between 18 and 20 % of GDP, (INS).

credits are not refunded and the other one is applied on the composite price of final consumption.

VAT system with exempted goods:

$$(1)\mathrm{PVA_{exo}} = \mathrm{PP_{exo}} * (1 - \mathrm{TX_{exo}}) - \sum_{j} (\mathrm{AIJ_{j,exo}} * \mathrm{PCI_{j}})$$

Exo: Producer of the exempted good; $\mathrm{PVA_i}$ Value added price; $\mathrm{PP_i}$ Production price of i; $\mathrm{TX_i}$ Production tax rate; $\mathrm{PCI_i}$ Price of intermediate consumptions; $\mathrm{AIJ_{i,j}}$technical coefficient; $\mathrm{PQ_i}$ Composite good price

$$(2)\mathrm{PCI_{exo}} = \mathrm{PQ_{exo}} * (1 + \mathrm{TCI_{exo}})$$

$\mathrm{TCI_i}$VAT rate on intermediate consumption.

$$(3)\mathrm{TCI_{exo}} = \frac{\sum_j \mathrm{TC_j} * \mathrm{PQ_j} * \mathrm{CIJ_{j,exo}}}{\sum_j \mathrm{PQ} * \mathrm{CIJ_{j,exo}}}$$

$$(4)\mathrm{RTVA} = \sum_{ass} \mathrm{TC_{ass}} * \mathrm{PQ_{ass}} * (\sum_{h} \mathrm{C_{ass,h}} + \mathrm{CG_{ass}}) + \sum_{i} \mathrm{TCI_{exo}} * \mathrm{PQ_{exo}} * (\sum_{j} \mathrm{CIJ_{exo,j}})$$

$\mathrm{CG_i}$ Government consumption of good i; $\mathrm{CIJ_{i,j}}$ Intermediate consumption of i by j ; $\mathrm{C_{i,h}}$ Household consumption of good I; RTVA VAT revenue; TC is exogenous for the exempted sector and equal zero. TCI is endogenous. The VAT exemptions are thus taken into account and the VAT is not only a consumption tax.

The multiple rates VAT design when VAT credits are not refunded:

The sector subject to the reduced VAT rate is the only one which holds VAT credits (rec). It can retain VAT revenues received on its sales to offset the non-reimbursement of its VAT credits. This will reduce the cost of cascade effects and the government VAT revenue.

Reduc: producer of the good subject to the reduce VAT rate

$$(5)\mathrm{PVA_{reduc}} = \mathrm{PP_{reduc}} * (1 - \mathrm{TX_{reduc}}) - \sum_{j} (\mathrm{AIJ_{j,reduc}} * \mathrm{PCI_{j}} * (1 - \mathrm{rec_{reduc}}))$$

$$(6)\mathrm{PCI_{reduc}} = \mathrm{PQ}_{reduc} * (1 + \mathrm{TCI_{reduc}})$$

$$(7)\mathrm{TCI_{reduc}} = \frac{\sum_j \mathrm{TC_j} * \mathrm{PQ_j} * \mathrm{CIJ_{j,reduc}}}{\sum_j \mathrm{PQ} * \mathrm{CIJ_{j,reduc}}}$$

$$(8)\mathrm{rec_{reduc}} = \frac{\mathrm{TC_{reduc}} * \mathrm{PQ_{reduc}} * (\sum_h \mathrm{C_{reduc,h}} + \mathrm{CG_{reduc}})}{\mathrm{DD_{reduc}}}$$

DD_i Domestic demand; rec is the VAT rate paid by the consumer on final consumption. Sectors subjected to a full VAT rate do not have VAT credits. The VAT paid on inputs is smaller than the VAT paid on finale consumption. These producers stay neutral when faced to the multiple rates VAT.

Full: Sectors subjected to a full VAT rate

$$(9)\mathrm{PVA_{full}} = \mathrm{PP}_{full} * (1 - \mathrm{TX_{full}}) - \sum_{\mathrm{j}} \left(\mathrm{AIJ_{j,full}} * \mathrm{PCI_j}\right)$$

$$(10)\mathrm{PCI_{full}} = \mathrm{PQ}_{full} * (1 + \mathrm{TCI_{full}})$$

with TCI exogenous and equal zero.

$$(11)\mathrm{RTVA} = \sum_{\mathrm{full}} \mathrm{TC_{ful}} * \mathrm{PQ_{full}} * \left(\sum_{\mathrm{h}} \mathrm{C_{full,h}} + \mathrm{CG_{full}}\right),$$

VAT revenue from the sector taxed with the reduce rate equal zero. The initial VAT rate depends on the VAT collected on intermediate consumption goods which is a fixed proportion of the total VAT collected on the item.

$$(12)\mathrm{TCO_i} = \frac{\mathrm{TAXCO_i} * (1 - \mathrm{proptvacio_i})}{\sum_{\mathrm{h}} \mathrm{CO}_{i,h} + \mathrm{CGO_i} - \mathrm{TAXCO_i} * (1 - \mathrm{proptvacio_i})}$$

$$(13)\mathrm{TCIO_i} = \frac{\mathrm{TAXCO_i} * \mathrm{proptvacio}}{\sum_{\mathrm{j}} \mathrm{CIJO_{i,j}} - \mathrm{proptvacio_i} * \mathrm{TAXCO_i}}$$

proptvacio: Proportion of VAT revenues collected on intermediate consumptions goods for each type of good. TAXCO: Total VAT revenue collected on goods, SAM 2004.

The fact that VAT is collected on intermediate goods in food crop agriculture can be explained by the large number of exemptions but also by the informality of the sector. In export agriculture, having VAT collected on intermediate goods is due to the non-application of zero-rate.[10] In industry, VAT exemptions primarily concern the mining sector and firms that produce food, beverages, and tobacco. In services, it is mostly hotels and restaurants that are concerned. According to government statistics, 80% of total VAT revenue collected on food crop agriculture goods is collected on inputs; 60% for export agriculture, and 30% for the sector of industry and services.[11] Sectors that bear the greatest tax burden on intermediate consumption are in fact export agriculture and industry. This assessment is related to the level of input use in production.

[10] Report*: 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.*

[11] Information on the sum of exemptions is provided by the country's fiscal office for the year 2006.

The burden of VAT collected on intermediate consumptions in the initial situation influences the results of our simulations when the pure VAT system is re-established and when the cascading effect is cancelled. With rates of tax collected, we obtain the effective VAT rates presented in Table 1.

Table 1: Effective VAT rates in Niger according to sector and tax base

Sectors	TC rate	TCI rate
Food crop agriculture	0.2	8.51
Export agriculture	0.60	5.00
Industry	10.00	7.30
Service	0.10	0.20

TC: VAT rate on final consumption, TCI: VAT rate on intermediate consumptions. Authors' calculations based on data from the SAM, 2004.

We have considered low substitution elasticities of foreign trade for all products. In other words, we assume in standard fashion that there is a significant differentiation between domestic, exported, and imported products (de Melo 1998). We have done the same for the substitution elasticity of production factors (Appendix 3).

3. Differential analysis of the social impacts of different VAT design:

Six simulations have been run to analyse the effects of abolishing exemptions. The first two (simulations 1a and 1b) consider proposal debated to apply a uniform rate and broadening the tax base to primary consumer goods. These simulations capture the implementation of a pure VAT in the Nigerien economy in its theoretical dimension: no VAT on intermediate inputs for any sectors representing the absence of VAT exemptions. In simulation 1a, we restore the official rate of 19% VAT stipulated by the Finance act. In simulation 1b, we reduce the VAT rate at 10% as a result of the expansion of the tax base, which is consistent with the logic of the single rate. The endogenous public revenue allows us to assess the impact of a pure VAT on both public revenues and poverty.

The principle of "Equal Yield Tax Analysis" (Shoven and al., 1990) is made for the four following simulations. It aims to compare various taxation schemes while keeping constant the public expenditure and the government income. This analytical approach is adapted to capture the intrinsic incidence of alternative tax scenarios by isolating them from induced effects which may be related to the change in the State revenue, the State expenditures and savings. The public

revenue in simulation 1b has been used as reference.

Simulation 2a and 2b take into account the difficulty of taxing food crop in developing economies. These goods are mostly traded on informal markets or are self-consumed, which makes their consumption difficult to tax. Simulations 2a and 2b show the net social impact of the existence of legal or illegal exemptions in food crop agriculture. These goods are totally VAT exempted. In simulation 2a, VAT rate on intermediate consumption is fixed at the reference level considering that food crop agriculture is expanding in the non-taxed market. In simulation 2b food crop agriculture is exempted but the sector has to pay full VAT rate in its input. For this simulation, we consider that food crop agriculture inputs are obtained by the formal market. Simulation 2a and 2b are run under budget neutrality. The VAT rate in other sectors is endogenous and uniform.

In simulation 3a, we applied a 5% reduced rate on the whole of food crops. Once again with budget neutrality, the VAT rate in the other sectors is endogenous and uniform. This simulation is in conformity with economic theory of multiple rates without taking into account realities tied to self-consumption and the informal sector. It captures the hypothetical situation whereby the Nigerien's tax authorities would have the ability to control and reimburse VAT credits. In simulation 3b producers have to support cascade effects due to the inefficiency of the administration. It takes into account the rigidity of a pure VAT system in order to test the hypothesis of the progressivity of a double-rate VAT system.

We summarize the simulations on the following table:

Simulations	Description of simulation
Sim 1a	Without budget neutrality, 19% VAT on all sectors, no VAT paid on inputs
Sim 1b	Without budget neutrality, 10% VAT on all sectors, no VAT paid on inputs
Sim 2a	Budget neutrality, Exemption for Food crop agriculture, partial VAT on inputs
Sim 2b	Budget neutrality, Exemption for Food crop agriculture, full VAT on inputs
Sim 3a	Budget neutrality, reduced 5% VAT rate for Food crop agriculture, VAT on inputs reimbursed
Sim 3b	Budget neutrality, reduced VAT rate for Food crop agriculture, VAT on inputs not reimbursed

Before proceeding to a distributional analysis a presentation of the sectorial and macroeconomic results is performed. The macroeconomic results of simulation 1b corresponding to the reference simulation are detailed for the comparative analysis under the hypothesis of budget neutrality.

4. Macroeconomic and microeconomic results:

a. *Macroeconomic results*

Results of simulations 1a and 1b

In the two first simulations (1a and 1b), all possibilities of imperfection related to the application of VAT have been eliminated (absence of informal sector, improved tax collection, absence of market power). VAT rate on final consumption increases considerably compared to the original situation (observed data in the SAM). The results of simulation 1b, will serve as the reference simulation for the subsequent comparative analysis. The results of simulation 1a are presented in Table 2 and these shed light on what would take place with the application of a pure VAT system associated with a high rate.

In this simulation (1b), two effects are combined. The first is related to the end of VAT exemptions and the second, to the establishment of an effective VAT rate of 10%. The restoration of VAT neutrality in the production process leads to a decrease in the cost of intermediate consumptions, which increases the value added price, irrespective of sectors. While the value added increases in food crop agriculture and services—expanding sectors—it decreases in industry and export agriculture. The increase in value added is nonetheless not sufficient in these two sectors to compensate the increase in cost of the labour. There is a reallocation of labour towards food crop agriculture and services. In terms of foreign trade, this simulation shows that from this point on, the same tax level applies when selling locally or exporting (the zero rate of VAT being correctly applied) and the decision between these two options is made solely according to relative prices. Contrary to other sectors, domestic price in industry decreases, which favours exports and reduces the price for the producer (the largest share of industrial production is sold locally). This situation favours the purchase of locally produced goods. The domestic price for other goods including export agriculture increases. It penalizes domestic goods in favour of imported goods. The export agriculture and industry sectors experience a different impact compared to other branches given the greater VAT burden on their intermediate inputs and their positioning on the international market.

When we introduce an official 10% VAT rate on the all goods and services, we observe a different net effect compared to the elimination of VAT exemptions. On the local market, while the decrease in domestic price resulted in a reduction of the composite prices and producing a drop in the price of intermediate consumptions, the VAT rate strongly increases consumption prices, which reduces domestic demand. The only sector that does not follow this trend is the industrial sector, as it benefits from a sufficient reduction in the price of the composite good in

order not to push consumption price upwards. Since industry is predominant in the economy (production and investment[12]), this amplifies the demand for the industrial goods. Decreases in the value added price leads to decreases in the labour demand in all sectors but industry. The variation of factor payments and factor allocation affects the households' disposable income and thus their welfare, poverty level, and inequalities; this is analysed in the distributional analysis.

Concerning public finances, the end of exemptions and the increase in the effective VAT rate yields a considerable increase in tax revenues. The government benefits from exemption suppressions and from the re-establishment of a 10% effective VAT. VAT revenues now represent 11.70% of the GDP and overall government revenue is increased by 28.88%. The result in terms of public finance is nevertheless conditional to the efficiency of the tax collection agency. The positive effect on public finance results in an increase in total investments by 77.49% public savings is the only agent increasing its savings. The reduction in VAT exemptions allows the industrial sector to expend by increasing the domestic demand (intermediate consumption, investment) as well as its participation in foreign trade, while the size of other sectors are reduced due to the strong reduction in households' local demand.

Results of simulations 2a and 2b

The VAT rate in sectors other than food crop agriculture is 13.4% in simulation 2a and 13.3% in simulation 2b. Preserving food crop agriculture as an under-taxed sector (simulation 2a) or an officially exempted sector (simulation 2b) requires increasing the VAT rate on other goods comparing to others simulations. Through a stabilization of domestic demand these VAT designs lead to an implicit support to the food crop agriculture. Nonetheless the producers must support cascade effects which reduce value added price. Producers in food crop agriculture sector have to support 8.5% VAT rate on their inputs in simulation 2a and 11.41% in simulation 2b. The most important result is the small difference between the macroeconomics results of simulation 2b taking into account the full payment of VAT in the food crop agriculture inputs and the simulation 2a which considers the informality of the food crop agriculture. Contrary to theoretical expectations, the value added price decreases only slightly when this sector is exempted from VAT. Nigerien farmer's do not use enough inputs and are therefore are not penalized by exemptions. The additional cost introduced by the VAT exemption is cancelled by a decrease in the consumption price of the goods concerned and by a stable demand. Finally the net distributional impact of VAT exemptions depends on the economic structure of sectors and the initial tax burden on intermediate consumption. Food crop agriculture maintain its level of

[12] The Investment increases since it is not subject to VAT

activity compared to other sectors (except the industry, cf. simulation 1b) experiencing a slow-down in their production.

Simulations 3a and 3b

A VAT system with multiple rates is introduced in the model with a 5% reduced rate in food crop agriculture and an endogenously determined and uniform VAT rate on the other sectors. In simulation 3a, we assume a perfectly efficient tax collection agency in Niger. There is no charge on inputs and others goods have a 11.80% VAT rate. These hypothesis lead to the following findings: First, whereas the reduce rate favours food crop agriculture demand and production less than exemptions scenarios, the impact of the reduce rate is similar in other sectors. Also, from an economic growth point of view, the multiple rates system works quite well, albeit, the best option is observed with a uniform tax rate.

In simulation 3b, VAT credits are not refunded reflecting an inefficient tax collection agency. This problem concerns only the food crop agriculture with a 13.4% VAT rate on its inputs. Others sectors do not support this cascade effects. The VAT rate on final consumption for the other goods is 14.8%. The VAT revenue now corresponds to 15.2% of GDP, which is higher than the WAEMU average. This simulation represents the worst situation in terms of economic growth even compared to the 19% uniform VAT rate scenario. The high VAT rate on final consumption reduces the private consumption and then the global demand. This leads to lowering the production in all sectors apart from the industry (cf. simulation 1b). The non-food agriculture goods have to support a higher rate of VAT compared to simulations 2a and 3a. It can be explained as follows: food crop agriculture handles a part of VAT revenue which reduces government revenue while consumers still have to pay the tax which reduces demand and tax base. The decrease in domestic prices and demand leads to reduce economic activity more than the scenario with the cascade effect on food crop agriculture. Indeed, the strong decrease in domestic prices creates a reduction for both producer and composite price. Finally, the input prices decrease even if the input tax is high. The value added price, the wage rate and the return to capital are thus decreasing.

To summarize, we observe that in spite of the budget neutrality hypotheses very different macroeconomic effects for the scenarios. For economic growth, the uniform rate is the best option. However, it is important to analyse the social incidence of each VAT design with the distributional analysis.

Table 2: Macroeconomic results (Δ %):

Labour demand						
Wage rate	-2.17	0.14	-0.70	-0.83	-0.27	-4.64
food crop agriculture	-9.39	-4.99	-0.08	-0.09	-2.71	-2.36
export agriculture	-4.15	-2.89	-4.41	-4.35	-3.73	-3.70
industry	19.81	10.97	9.73	9.65	10.66	11.81
services	-7.32	-3.76	-5.32	-5.29	-4.62	-5.96
Return to capital						
food crop agriculture	-16.99	-8.31	-0.83	-0.97	-4.73	-8.35
export agriculture	-8.84	-4.90	-7.89	-7.90	-6.40	-10.45
industry	32.22	18.78	15.92	15.64	18.07	14.86
services	-13.81	-6.32	-9.35	-9.42	-7.83	-13.93
Foreign trade						
Exports						
export agriculture	-2.52	-2.19	-3.37	-3.28	-2.89	-1.20
industry	21.80	12.15	10.96	10.86	11.91	14.62
Imports						
food crop agriculture	-11.51	-5.62	-1.00	-1.08	-3.42	-6.60
export agriculture	-7.50	-4.01	-6.05	-6.07	-5.03	-9.49
industry	12.17	6.50	5.23	5.21	6.03	2.44
Domestic demand						
food crop agriculture	-8.71	-4.62	-0.07	-0.08	-2.50	-2.18
export agriculture	-4.21	-2.80	-4.27	-4.22	-3.61	-4.05
industry	18.50	10.24	9.01	8.95	9.91	10.41
services	-6.81	-3.50	-4.95	-4.92	-4.30	-5.55
Public finance						
Government tax revenue	71.00	28.88	28.88	28.88	28.88	28.88
Public savings	582.63	233.06	248.04	248.04	248.04	248.04
VAT revenues	247.31	86.04	97.88	97.56	92.45	130.23
VAT/GDP	22.36	11.71	12.52	12.51	12.13	15.17
Various indicators						
General price index	110.83	104.59	104.21	104.11	104.51	102.60
Total investment	77.49	31.41	32.85	32.78	33.14	30.38
Traded GDP	-2.66	-0.42	-0.94	-1.07	-0.54	-4.93
Non-traded GDP	-1.82	-0.11	-0.81	-0.92	-0.47	-4.24
Representative agent						
Household welfare	-15.75	-6.23	-6.74	-6.72	-6.66	-9.10
Net income	-2.29	-0.36	-1.16	-1.26	-5.04	-4.50
Private consumption						
food crop agriculture	-11.31	-5.94	-0.81	-0.82	-3.56	-3.72
export agriculture	-14.45	-7.46	-9.33	-9.27	-8.58	-9.96
industry	-8.57	0.03	-2.56	-2.58	-1.35	-4.73
services	-14.47	-7.28	-9.28	-9.23	-8.45	-10.44

b. Distributional analysis

The micro-simulation module linked to the CGE model allows for a rich distributional analysis of economic policy using all households from the national survey. This technique takes into account the heterogeneity of households in terms of both their income structures and their expenditure structures observed in the survey. This type of analysis is not possible with an approach based on representative agents. Moreover, according to Savard (2005), distributional analysis by representative agent can lead to qualitatively and quantitatively different conclusions. Using real income changes for distributional analysis allows one to capture the income and price effect since each household has a specific price index. Indeed, the model allows us to obtain new income, expenditure vectors and a household specific price index after each simulation of economic policies implemented. New real income vector are computed after each simulation and thus it is possible to re-estimate poverty and inequality indices at the reference period and for each scenario.

Our study draws on data from the 2005 *Questionnaire Unifié sur les Indicateurs de Base du Bien-être* (QUIBB) including 6 690 Nigerien households. The poverty analysis is performed using the usual Foster, Greer and Thorbecke (1984) poverty measures (FGT) [13]. This covers poverty incidence, depth, and severity. The poverty line used is 105 827 CFAF per year per capita in rural areas and 144 750 CFAF in urban areas in 2005 (PNUD 2005). As for the inequality measure, we selected the Gini index.

We decomposed household in four groups based on two criteria. First, household we decomposed based on a rural-urban divide and second, the main activity of the head of households (agriculture or non-agriculture). The four groups analysed are thus Uagr, Ragr, Unagr, Ragr respectively representing 3.2%, 60%, 13.1%, and 23.7% of Nigerien households.[14]

Table 3: Structure of average consumption among Nigerien households

Household groups	Uagr	Ragr	Unagr	Rnagr
Food crop agriculture	43.66	56.53	38.26	52.40
Export agriculture	16.48	14.33	16.94	15.37
Industry	34.06	25.58	33.72	27.53
Services	5.8	3.56	11.08	4.7
Total	100	100	100	100

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

[13] The distributional analysis was conducted using DASP (Distributive Analysis Stata Package) software.

[14] It is important to point out that the decomposition of households is independent from the CGE model. It is carried out based on data from the QUIBB survey and other decomposition can be done without changing the CGE or micro-simulation models.

Regardless of the group, the average per capita expenditure of households in food crop agriculture remains the largest expenditure item, followed by the industrial good. The importance of expenditures in agricultural goods may justify the fact that government and donor agencies target an expansion of the tax base towards this sector. We observe a stronger difference in the consumption structure for the residential zone divide compared to the head of household's activity decomposition. For urban households with or without agricultural activity, food crop agriculture exhibit lower share of expenditure and their consumption is more diversified. Industrial goods and services occupy a slightly less important place in their budget (

Table 3).

We observe a relation between agriculture households and the level of poverty, irrespective of the area of residence. The group least affected by poverty is the urban non-farmers (34%) while rural households headed by a farmer are the most affected (70.8%). The Gini coefficient measuring the degree of inequalities has a value of 0.462 in 2005 in Niger (INS). Regardless of the group examined, the within group inequalities is similar despite a slightly higher rate among urban dwellers who do not obtain their revenue from agriculture (0.434).

Table 4: Analysis of poverty and inequalities in Niger

	Uagr	Ragr	Unagr	Rnagr
% population	3.2%	60%	13.1%	23.7%
Incidence (FGT0)	70.8	64.4	34.0	53.1
Depth (FGT1)	30.3	25.8	10.8	19.4
Severity (FGT2)	15.9	13.3	4.8	9.6
Gini	0.427	0.429	0.434	0.428

Source: Authors' calculations based on data from the QUIBB_2005; all results have been multiplied by 100. simulations.

Budget neutrality allows us to evaluate the effects of various VAT systems by dissociating macroeconomic effects from microeconomic effects. First, we can see that regardless which simulation is considered, all poverty indices increase compared to the reference period. The extent of the deterioration of the situation differs according to the group and the simulation.

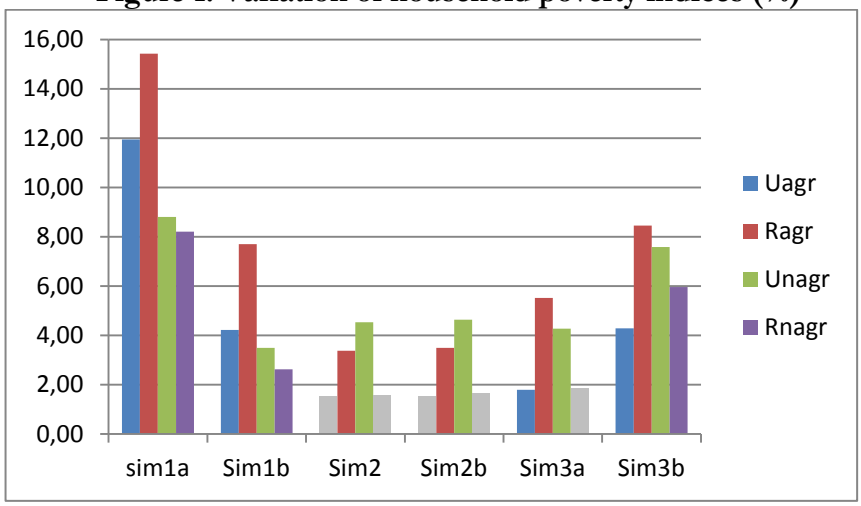
Figure 1[15] presents the variations in the FGT indices for the four household groups and for the six simulations.

Budget neutrality allows us to evaluate the effects of various VAT systems by dissociating macroeconomic effects from microeconomic effects. First, we can see that regardless which

[15] The results for each simulation and for each poverty index are available in Appendix 5.

simulation is considered, all poverty indices increase compared to the reference period. The extent of the deterioration of the situation differs according to the group and the simulation.[16]

Figure 1: Variation of household poverty indices (%)



Source: Authors calculations, results of the micro simulation on DASP. Results in grey are non-significant.

The expansion of the tax base to the whole of consumer goods and the re-establishment of a pure VAT system is costly in social terms (simulations 1a and 1b). If we consider simulation 1b, we can see that the most negatively affected group is the agricultural rural households (Ragr) with a 7.70% increase in poverty incidence. It is the most numerous and the second poorest group. For this simulation, the increase of the poverty level and severity is nevertheless greater for those in urban agricultural households (Uagr) which is the poorest household group at the reference situation. It is also interesting to highlight that even if the effects on poverty are greater in terms of impacts on agricultural households residing in rural areas compared to those in urban areas, the variations in average income in these two groups are very similar (Appendix 4). This suggests that price effects play an important role for changes in poverty indices for rural agricultural households. We should note that this is true regardless of the simulation analysed, even if it is less obvious in other cases. Households obtaining their income from a non-agricultural sector are less affected. It can also be observed that reducing the VAT rate to 10% (simulation 1b) reduces the negative social repercussions of an expansion of the tax base compared to a 19% single rate (simulation 1a).

Considering a more realistic tax base by maintaining food crop agriculture exempted from VAT has less negative effects in terms of poverty variation (simulation 2a and 2b).. The variation of poverty on rural agricultural households' drops from 7.70% to 3.38% in simulation 2a and 3.50% in simulation 2b compared to the reference period. A variation of cascade effects for the food

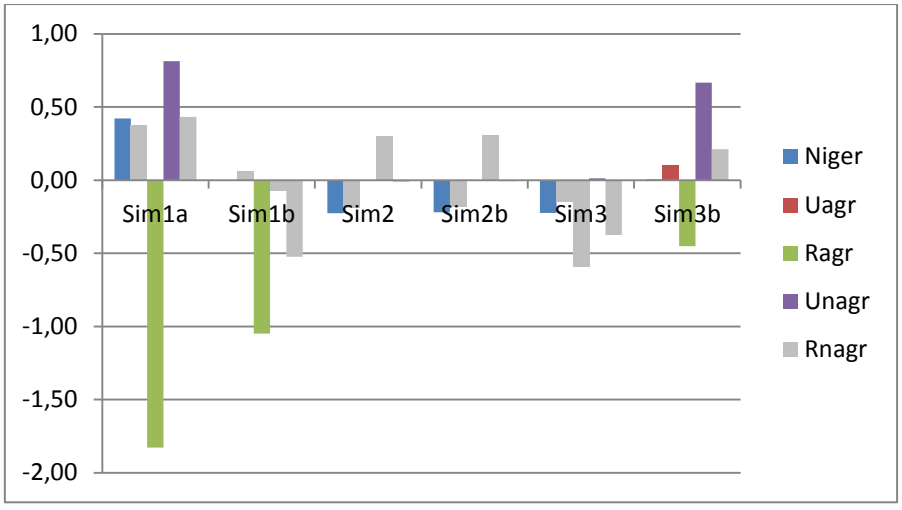
[16] This is consistent with negative variations in average revenues observed in Appendix 4.

crop agriculture has little impact on the poverty indices.

Establishing a VAT design with multiple rates (simulation 3a) amplifies poverty mainly for rural farmers (5.52%) and urban non farmers (4.27%). The negative social impact of this VAT system seems to be weaker than in a single-rate VAT system (simulation 1b) for rural farmers but not for urban non farmers. With a multiple rates system (simulation 3a), poverty increases for this group due to a decrease of their incomes. If VAT credits are not refunded (simulation 3b), the poverty impact of the multiple rate system is more costly. Moreover, the multiple-rates VAT design is the worst option for all social groups. The best solution in terms of poverty is maintaining exemptions in food crop agriculture (simulation 2a and 2b).

The results in terms of inequality are much weaker. A reduce rate (simulation 3a) or exemptions (simulation 2a and 2b) in food crop agriculture creates less inequalities at the national level compared to a single rate even if VAT credits are not refunded (simulation 3b). The uniform rate system (simulation 1b) decreases inequalities among rural households regardless of their activity more than a multiple rate system if VAT credits are not refunded (simulation 3b). Indeed this VAT design increases inequalities among non-farmers groups and among urban but still generates as in others simulations, the inequality reduction among rural farmers. The best option to reduce inequalities at the national level seems to be maintaining exemptions or under taxed activities in food crop agriculture (simulation 2a and 2b) (Figure 2).[17]

Figure 2: Variation in the Gini index (%)



Source: Authors calculations, results of the micro simulation on DASP, results in grey are non-significant.

[17] The complete results and significance for each simulation are available in table form in Appendix 6.

Although restoring the VAT rate (simulation 1a and 1b) would be socially costly compared to the initial situation, we can see that the distributional impact of the VAT differs according to the system implemented in the country. As for the impact on poverty, we can highlight that the establishment of a single-rate for the VAT associated with maintaining exemptions (simulation 2a and 2b) in food crop agriculture is more preferable for all social groups identified, since the negative effect are the weakest. Moreover, the reduction observed in inequalities suggests that although the number of households under the poverty line would be higher, it may be possible to target a larger number of households during the establishment of targeted compensatory measures in favour of the poor.

Conclusions

This study has sought to describe the distributional impacts of expanding the tax base to all consumption goods by considering various potential taxation options. To do so, we built the first CGE micro-simulation model for Niger and performed a rich distributional analysis of a VAT reform. Three main findings emerge from our application.

First, the end of VAT exemptions is useful to develop the industrial sector, which has a strong ripple effect on the rest of the economy. Nonetheless, maintaining VAT exemptions in food crop agriculture sectors associated with a tax base expansion in the remaining sectors is preferable for the food crop agriculture expansion. On one hand, this fiscal choice avoids an increase in the tax burden on consumers which are supporting demand. On the other hand, agriculture being a sector that uses little intermediate consumption goods, the tax burden tied to VAT exemptions is weak for the producer, which maintains the level of activity of this sector and hence the income of farmers. The net impact of VAT exemptions depends on the economic structure of the sector and also on the initial tax burden on intermediate inputs.

Secondly, the model shows that applying a pure VAT structure in conformity with the theory (simulation 1b) is preferable in terms of economic growth whereas applying a reduced-rate on food crop agriculture lightens the negative distributional impact on the elimination of exemptions compared to a single rate (simulation 3). Both simulations without any imperfection in VAT application are border cases. The conclusion is different if VAT credits are not refunded by the Nigerien's administration. If VAT credits are not refunded, the multiple rates VAT design can become the worst option for the Nigerien economy. It shows that it is extremely important to consider the producer situation when implementing VAT reforms. Maintaining VAT exemptions in food crop agriculture (simulation2) is the most judicious choice compared to a 5% VAT rate taxation of goods produced by this sector. Contrary to the theory, in Niger, it is not the multiple rate VAT that is more progressive but the one with the tighter fiscal base. Allocating

taxes on all goods increases poverty.

This study is the first to take into account both consumer and producer point of view in a distributional impact analysis of different Vat designs: establishment of a single rate, multiple rates, or maintaining exemptions on certain good. The social impact of these systems depends on the ability of the Nigerien's tax authorities to control and reimburse VAT credits. We intend to pursue this analysis by modifying certain hypotheses of the model and introducing different market structures in certain sectors of the economy. This will allow us to take into account the power of retailers and/or producers to determine market prices.

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6. Appendix

Appendix 1: Presentation of the sectors of the Nigerien economy

	Food crop agriculture	Export agriculture	Industry	Services
Mi/Qi	9.39	6.21	37.62	
Mi/M	9.48	4.74	85.79	
EXi/XSi		24.44	77.56	
EXi/EX		31.36	68.64	
VAi/VA	21.99	21.90	25.71	30.40
VAi/XSi	87.85	87.20	57.54	73.29
XSi/XS	18.37	18.42	32.78	32.78
LDi/LD	22.67	22.28	26.11	28.94
KDi/KD	29.31	28.80	6.81	35.08
LDi/VAi	95.18	93.94	93.77	87.86
KDi/VAi	8.04	7.93	1.60	6.96

I: sectors, Mi: imports, EXi: exports, Qi: quantity of available goods in the economy, VAi: value added, XSi: Production, LDi: labour factor demand, KDi: capital factor demand.

Authors calculations, SAM 2004

Appendix 2: Matrix of technical coefficients

	Food crop agriculture	Export agriculture	Industry	Services
Food crop agriculture	0.012	0.012	0.041	0.009
Export agriculture	0.01	0.024	0.049	0.006
Industry	0.041	0.048	0.226	0.129
Services	0.033	0.003	0.091	0.146

Authors' calculations, SAM 2004

Appendix 3: Elasticities used in this model

	Food crop agriculture	Export agriculture	Industry	Services
Sigma	0.6	0.6	0.6	0.6
Sigmam(1)	0.8	0.8	0.8	
Sigmae(2)		0.4	0.4	

(1) is the substitution elasticity of the Armington function (CES) for imports and (2) is the transformation elasticity of the CET function for exports.

Appendix 4: Variation of real average income of household groups (%)

	Uagr	Ragr	Unagr	Rnagr
sim1a	-24,60	-28,81	-17,02	-14,42
sim1b	-13,17	-15,81	-7,82	-8,06
sim2	-8,20	-5,71	-9,26	-3,83
sim2b	-8,29	-5,84	-9,32	-3,98
sim3	-11,00	-11,16	-8,96	-5,35
sim3b	-15,63	-15,63	-14,17	-10,68

Authors' calculations

Appendix 5: Simulation results in terms of poverty

		Uagr	Ragr	Unagr	Rnagr
sim1a	FGTO	11,95**	15,42**	8,80**	8,21**
	FGT1	12,14**	12,02**	5,84**	6,08**
	FGT2	9,51**	8,36**	3,45**	3,81**
Sim1b	FGTO	4,22**	7,70**	3,49**	2,63**
	FGT1	6,10**	5,82**	2,13**	2,06**
	FGT2	4,62**	3,83**	1,11**	1,09**
Sim2a	FGTO	1,53	3,38**	4,54**	1,58
	FGT1	3,76**	2,15**	2,71**	1,27**
	FGT2	2,76**	1,30**	1,45**	0,60**
Sim2b	FGTO	1,53	3,50**	4,64**	1,66
	FGT1	3,81**	2,20**	2,74**	1,33**
	FGT2	2,79**	1,34**	1,47**	0,64**
Sim3a	FGTO	1,80**	5,52**	4,27**	1,86
	FGT1	5,00**	4,05**	2,44**	1,63**
	FGT2	3,72**	2,58**	1,28**	0,81**
Sim3b	FGTO	4,29**	8,46**	7,58**	5,96**
	FGT1	7,34**	5,66**	4,74**	2,73**
	FGT2	6,18**	4,10**	4,160**	2,48**

Authors' calculations, results of the micro simulation on DASP. **significant for a threshold of 5%

Appendix 6: Simulation results in terms of inequalities

	Sim1a	Sim1b	Sim2a	Sim2b	Sim3a	Sim3b
Niger	0,42**	0	-0,23**	-0,22**	-0,22**	0,01
Uagr	0,37	0,06	-0,19	-0,18	-0,15	0,1**
Ragr	-1,83**	-1,05**	-0,01	0	-0,59	-0,45**
Unagr	0,81**	-0,07	0,3	0,31	0,01	0,67**
Rnagr	0,43	-0,52	-0,01	-0,01	-0,37	0,21

Authors' calculations ***significant at 5%*