Fighting the soaring prices of agricultural food products. VAT versus Trade tariffs exemptions in a context of imperfect competition in Niger : CGE and micro-simulation approach

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Abstract

As happened in West Africa in 2008, in an imported inflation context, it is common for the governments to take short-term tax action to protect the poor: VAT or trade tariffs exemptions. As part of the tax-tariff transition, the comparison between Trade tariffs and VAT has already been the subject of much works. The introduction of VAT, as a tax on final consumption, is supposed to be optimal, due to its economically neutral aspect for production decisions. However, some authors show that in developing countries, a large informal sector affects this result. In this paper, we use a CGE model and a micro-simulation model to compare the effects of VAT and Trade tariffs exemptions to combat rising agricultural food prices. The approach is innovative because it integrates how VAT works in developing countries (VAT increases production costs for some producers), in a context of imperfect competition for the service of marketing products. Results show that VAT exemptions are more effective than Trade tariffs exemptions in limiting the effects of the rise in world prices on poverty in Niger. In the context of the current increase in food prices linked to the Covid-19 crisis (FAO, 2020), this issues may one again be in the limelight for the African governments.

Keywords

Computable general equilibrium model, Imperfect competition, Indirect taxes, Poverty, Niger

JEL Codes

D58, D43, E62, H22, I32

1. Introduction

According to FAO, between 2002 and 2008, grain prices has doubled and the price of foodstuff has increased by over 70% (Appendix A and B). While most articles analyze the effects induced by higher prices on the macroeconomic and microeconomic variables (Ivanic and Martin, 2008; Zezza & al., 2009; Badolo & Traoré, 2012), few of them are studying the impact of measures taken by governments to "control" this inflation (Boccanfuso and Savard, 2011; Wodon, 2011). However, to limit the impact of the rise of worldwide agricultural prices on households, customs duties were reduced in 76 countries and VAT has been suspended or exempted in 22 countries, between 2007 and 2008 (IMF, 2008, Appendix C). While these measures are significant tax expenditure for the governments[1], what could we expect in response to the sharp rise of worldwide prices in terms of economic and social efficiency? Is it better to be exempt from VAT or Trade tariffs, or to let the free markets work? With the increases of more than 30% in the price between April and November 2020, because of the COVID crisis, Global food commodity prices rose sharply to their highest level in nearly six years (FAO website, December 2020). These issues may once again be important for governments of developing countries.

The comparison between Trade tariffs and VAT has already been the subject of much works in Tax-Tariffs transition context (Clarete and Whalley, 1987; Cockburn, 2004; Cororaton and Cockburn, 2007, Shim and Jung, 2012; Kim and Kose, 2014; Buettner and Madzharova, 2018). The application of VAT as a tax on final consumption is deemed more favorable to economic efficiency than the application of tariffs for its economically neutral character for producers (Bathia, 1982; Dixit, 1985; Keen, 2008). For the same level of public revenue, economic theory thus suggests that it is preferable to exempt from Trade tariffs rather than VAT.

However, many authors also show that in developing countries, VAT can create more economic distortions than an import tax by promoting the development of the informal sector. Considering the informal sector as the least productive compared to the formal sector, the authors conclude that the introduction of VAT, with the same level of public revenue, leads to the social welfare loss (Piggott and Whalley, 2001; Emran and Stiglitz 2005; Hines, 2004; Munk, 2008). Auriol and Warlters (2012) compared the marginal cost of government levies for different tax systems by using a computable general equilibrium model (CGE) applied to 38 African countries. According to the tax system, firms can produce either in formal or in informal. The authors conclude that in most countries the tax structure that minimizes the marginal cost of public fund includes an internal indirect tax, a low import tax and zero export tax. However, internal indirect tax is modeled only as a tax on final consumption, which is

[1] In terms of fiscal spending, the effect itself will depend on the net effect between the rate decrease and the base value increase.

not the observed work of VAT in developing countries (Chambas et al., 2005, Ebrill et al. 2001, de Quatrebarbes et al., 2015).

The debate on the efficiency of VAT, led by Emran and Stigliz (2005), and Keen (2008) in particular, is based on the assumptions made about how VAT works. In this article, we consider VAT as it works in developing countries (Geourjon *et al.*, 2016). VAT tax is applied to consumer goods but it also affects the price of intermediate goods to VAT non-compliant producers (Keen, 2008), to VAT-compliant producers selling goods exempt from VAT and to VAT-compliant producers holding of outstanding VAT credits (Ebrill et al., 2001). We also consider the situation of imperfect competition for for the service of marketing agricultural food products.

The use of a CGE model associated with a micro-simulation model seems to be the best method to understand the impact of a tax measure on social welfare. A CGE model allows to deal with the complexity of how VAT works (informal sector, not taxable to VAT, VAT exemptions, VAT credits outstanding), while considering the economic distortions caused by the market power of merchants following the Cournot model. To address the tax exemptions policy, in a context of global inflation and protection of the poor, the macro model was coupled with a "Top-Down" micro-simulation model (Chen and Ravallion, 2004). The proposed CGE model is the first to consider how the VAT works in developing countries and the imperfect competition for the services of marketing agricultural food products, both for the CGE and the micro-simulation models.

Like many developing countries, Niger is a net importer of agricultural food products. These goods represent almost a third of the value of imports and constitute the second group of imported goods after capital goods. Since 2003, and especially between March 2007 and March 2008, the country has felt the effects of soaring world prices of food products such as rice and corn, and imports almost all of its consumption. Concurrently with the increase in prices of imported products, SIMA[2] notes a significant increase although less pronounced grain prices produced in Niger such as millet and local rice. Although the rising price of imported cereals encourages domestic production, the production-consumption balance remains negative. The diet is based largely on grains and food availability is not sufficient to meet the nutritional needs of the population (malnutrition affects around 29% of the population, SIMA 2010). Facing up to world price rise, Many African developing countries have taken short term tax measures in order to limit the rise in food prices for consumers: exemption from Trade tariffs and VAT on rice, milk, sugar and cooking oil[3]. Niger was no exception.

[2] Information System on Agricultural Markets.

[3] These measures have already been taken by the Circular No. 230 / MEF / DGD / DRRI of 11 March 2005: suspension from duties and taxes on imports of millet, sorghum, maize, cassava flour and animal feed.

The tax exemption for rice and sugar resulted in a shortfall of about 12 billion CFA francs in 2008, with little effect on prices and protection of the poorest populations. Merchants have been blamed for this weak transmission of exemptions on the prices of goods. In Niger, marketing sector contributes 10% to the national GDP and marketing costs (product packaging cost, transportation cost, processing cost, storage cost ...) are the highest in the agricultural sectors: 23% of the value of production in subsistence agriculture, 25% in commercial agriculture and less than 12% in other sectors.

The next section presents the debate about the impact of tax exemptions with soaring world prices. Section 3 describes how imperfect competition hypothesis is introduced into the CGE. Section 4 presents the simulations and the macroeconomic and microeconomic results. The final section offers some concluding remarks.

2. Market Power, Trade tariffs and VAT exemptions

Trade tariffs and VAT are both ad valorem taxes applied to the price of goods but the tax base and the tax mechanism at work differ.

2.1. A difficult comparison between VAT and Trade tariffs in developing counties

Trade tariff applies only to the prices of imported goods whatever their use in the economy (consumer goods, intermediate goods, capital goods). Trade tariff thus has two effects: it changes relative prices between imported goods and domestic goods and represents a final tax burden for the local producer in the use of imported inputs in the production process.

VAT is charged on all domestic sales by registered taxpayers, and on all imports, with credit or refund to VAT-compliant taxpayers of the VAT that has been charged on their own purchases. VAT is then only borne by the final consumer (theorem of Diamond and Mirrlees, 1971). According to this principle, the VAT does not affect the relative price between imported and domestic goods. This is not an instrument to protect domestic production. VAT is neutral toward production decision for VAT-compliant producers.

The situation is different for VAT non-compliant producers (informal producer and formal producers below the threshold of VAT) and formal producers subject to VAT but selling an exempt good. VAT pays on intermediate and capital goods (domestic or imported goods) cannot be refunded or deducted. VAT is then borne by the producer.

Developing countries such as Niger are mainly composed of VAT non-compliant producers: informal producers and formal producers whose turnover is below the VAT threshold. Following this observation and research line of the optimal tax, Emran and Stigltiz (2005) argue that informal producers

cannot avoid Trade tariffs even if they avoid VAT. Thus, for the same level of public revenue, the substitution of Trade tariffs by the VAT causes a transfer of demand to the informal sector, supposedly less productive and causes a loss of social welfare. However, unlike the reasoning developed by these authors, VAT non-compliant producers cannot deduct VAT paid on their inputs. If VAT non-compliant producers are not free of VAT, combining Trade tariffs and VAT can also improve welfare for a given level of revenues (Keen, 2008). However, Keen's model (2008) assumes that the good produced by informal producers is substitutable for the good produced by formal producers, but are non-tradable good. Emran and Stigltiz (2005), as Keen (2008), assume mainly that the size of the informal sector is given and independent of the tax system. Boadway and Sato (2009) challenge this assumption and the restrictive hypothesis of Emran and Stiglitz (2005) and Keen (2008). Their model allows determining the main factors that work in favor of VAT or Trade Tariffs regime. The results of these theoretical models are indeed very dependent on the assumptions made about the structure of the economy and how the VAT works.

Emini et al. (2010) study Tax-Tariff transition from a CGE model with micro-simulation in Cameroon. The model takes into account the VAT charge for VAT non-compliant producers, but there is no possible substitution between goods sold by the formal and informal sectors. They conclude that for the same level of public revenue, the substitution of Trade tariffs by the VAT leads to an increase in poverty, especially in urban areas and especially note that the severity of poverty increases.

The reasoning becomes even more complicated when the economic implications of Trade tariff exemptions are compared with those of VAT exemptions in the presence of an informal sector. Trade tariff exemptions correspond to a zero tariff rate, which reduces the tax burden applied to imported goods regardless of their use in the economy. A VAT exemption implies the application of a zero rate of VAT on both imported and domestic goods (regardless of their use in the economy). However, a VAT exemption restricts access to the principle of VAT deduction for VAT-compliant producers selling the exempted good. Thus, the VAT exemption creates a VAT burden for VAT-compliant producers selling the exempt good, which leads to an increase in production costs and may be unfavorable to the competitiveness of local production in competition with exempt imported goods (Chambas, 2005). Conversely, the consumption of goods exempted of TVA by VAT non-compliant producers also reduces their tax burden. Thus, VAT exemptions increase the tax burden of VAT-compliant producers selling exempt goods in direct competition with imports and reduce the VAT burden of VAT non-compliant producers.

Comparing Trade tariffs and VAT exemptions in the context of the agricultural prices increase is not easy and then requires the use of a model to take into account the direct and indirect effects of these measures.

2.2. The role of merchants in the incidence of tax exemptions

In order for tax policy to absorb soaring prices and for the tax expenditure to be effective, two elements come into play: the effective tax rate, certainly, but also the price of the marketing services. The result is therefore conditioned by the behavior of food merchants, which is often ignored in the analysis of tax policies[4].

However, as Gohin and Guyomard (2000), Bradford et Gohin (2006) and Mc Corriston (2002) have highlighted, the modeling of merchants is important not only for their intermediary role, but because they may have significant bargaining power that can affect significant price formation. Although the merchants operate in the informal sector in developing countries, they are extremely organized in Niger (Igué and Soulé 1992; Caupin and Laporte, 1998) and supports the development of the power market. A survey conducted in 1987 on the informal sector in Niger identifies several dozen large merchants dealing multibillion businesses FCFA per year (Oudin, 1990). These merchants are presented as very dynamic and constantly adapting their businesses to the economic constraints of the moment (change in exchange rates, prices of agricultural products, etc ...). It is then important to consider the market power of merchants in food price formation.

The literature has already studied the impact of a change in taxes on the market power of firms and shown that the transmission rate can be less than or greater than 1 (Carbonnier, 2007). In our research, it is not the producer whose product benefits from a tax change that is in a position of market power, but an intermediary producing the marketing services.

Gautier (2000) modelled in a CGE model the influence of a change in the tax context on re-export trade between Benin and Nigeria. Merchantss operate in a monopolistic market structure under the assumption of a fixed margin rate and then an endogenous margin rate. The merchants' selling price depends on the volume of re-export and their objective is to maximize their profit. He showed that a fixed mark-up rate leads to a higher profit than a variable mark-up rate in the case of an increase in customs duties in Benin, whereas in the case of a decrease in customs duties on the Nigerian market, adjusting the mark-up rate reduces the sector's losses. Paquet and Savard (2009) analyze the influence of an exchange rate appreciation and a Trade tariff cut on informal trade between Benin and Nigeria, bearing in mind the influence of reforms on Benin's tax revenues. The authors show that a decrease in customs duties or a reduction in the exchange rate has a greater impact on informal sector actors than on those in the formal sector. Laborde and Le Cacheux (2003) construct a multi-regional model to analyze the effects of a reduction in the protection of the agricultural and agri-food sector in the European Union. To do so, the authors take into account the market powers existing in the food chain

[4] The role of the merchantss is often told in trade relationship but not always taken into account in quantitative models.

(food industry and traders). Different hypotheses of imperfect competition are then taken into account. However, the different market hypotheses made by the authors lead only to slight differences in terms of welfare distribution between countries.

3. The market power of merchants in the micro-simulation model

The presentation of the specific modeling of VAT being made in Quatrebarbes et al. (2016), only specific modeling choices in this article are detailed here: the construction of the marketing service sector and the introduction of imperfect competition among merchants[5]. We will just remind that the proportion of informal production is considered as a constant one in our model.

3.1. The modeling of merchants in the CGE

The model is built on the assumption that a single marketing service sector sells imported as domestic goods. The level of production of the marketing service sector depends on the amount of composite goods demanded in the economy. The sale price of the composite goods (domestic and imported) is the price of the composite goods, including customs duties, which additively is associated with trading costs.

$$(1) PVM_i = PQ_{inc} + (MG_{inc} * P_{com})$$

PVM_i : Sales price of the composite good with trade margins ;PQ_i : Composite price of goods, including customs duties; MG_{com} : trade margin; P_{com} : Producer price of the marketing service sector.

Thus, the consumer price depends on the composite price of the good, including customs duties and trade margin in value, and the VAT rate applied. The VAT charge depends on the nominal VAT rate as well as the proportion of exempt goods sold by the sector.

$$(2) PC_i = PVM_i * (1 + (tcn_i * (1 - exo_i)))$$

PC_i: Price for final consumption; PQ_i : Composite price of consumer goods; tcn_i : Nominal rate of VAT; exo_i : Share of sales subject to VAT exemption.

The marketing service sector is supposed to work as an oligopolistic market structure. Thus, in addition to trading costs explained by the activity of merchants, a margin is introduced into the model for considering that the initial profit of the sector is positive.

Modeling of imperfect competition is consistent with Cockburn et al. (1998) and follows a Cournot's behavior. Production of merchants is assumed to be homogeneous, with competition in quantities and

[5] The equations about the modelling of the imperfect competition are available in Appendix D.

not in price. This assumption is justified in the developing countries, particularly in the case where merchants can play on the quantity of goods offered for sale on the market to influence the sale price (the phenomenon of storage of agricultural commodities for example).

In perfect competition, the price depends only on the marginal cost of production $P_{com} = Cm_{com}$. The conditions of profit maximization of the oligopoly are changing: the price P_{com} is determined by introducing a price mark-up to the marginal cost of production:

$$(3)\ \frac{P_{com} - Cma_{com}}{P_{com}} = markup_{com}$$

$\mathrm{P_{com}}$: Producer prices in imperfect competition; $\mathrm{Cma_{com}}$: Marginal cost of production; $\mathrm{markup_{com}}$: Mark up rate in the industry.

The marginal cost function is derived from the solution of the profit maximization for producers. The value of the marginal cost of merchants therefore depends on the cost of labor, capital, but also the cost of intermediate consumption, itself dependent on the VAT policy decided by government (Quatrebarbes et al. 2016).

The model considers an endogenous margin modeled as follows:

$$(4)\ markup = -\frac{1}{Nent_{com} * \varepsilon^{d}_{com}}$$

$\mathrm{markup_{com}}$: Mark up rates in the industry; $\mathrm{Nent_{com}}$: Number of firms in the market;
$\varepsilon^{\mathrm{d}}_{\mathrm{com}}$: Price elasticity of trade service demand.

The market power of the firm is then inversely proportional to the number of firms in the market and the price elasticity of demand perceived by the merchants[6]. When the market price is below the average cost of production, the firm exits the market. In the literature, a price elasticity of endogenous demand depends on the ratio between the value of imports and the value of the composite good (de Melo and Tarr, 1992). Modelling endogenous price elasticity does nothing in our situation because the trade service is only domestic. Price elasticity of demand is a constant in the model[7].

Merchants can also face fixed costs. Indeed, although the harvest period lasts only a few months, commodity consumption is spread throughout the year. Storage can be done with the operation, or at the merchant (private or trade marketing board) or consumer. We will assume in this study that preserving food is part of the activities of merchants. Thus, the cost of the food storage can be considered as a fixed

[6] The more the demand is elastic with regard to the price the more a price increase slow the demand itself. Thus, this is logical that prices do not spare a lot from too many costs. If there is only one firm, then we are in a situation in which prices only depend on the elasticity of the price of the demand.

[7] As the problem of estimation, let us suppose that the price elasticity of the demand is lower than -1 because there a few substitutable for the trading services.

cost. It is the same for the initial investment in the development of trade networks. To account for these aspects of the activities of merchants, an assumption of no constant returns to scale in the industry and an endogenous number of firms included in the model. Economies of scale are taken into account by the following equation system formulation Cockburn (1998). Gross margin of firms is thus directly influenced by the number of firms in the market. In a long-term perspective, with free entry and free exit of firms, an exogenous shock changing the number of firms in the sector therefore has an impact on the market power of each firm. The expression of endogenous margin was the subject of a number of articles, particularly because of the difficulty in determining the value of the price elasticity of demand for each type of goods present in a CGE model (Hoffman, 2003).

The profits from the market power situation are determined residually as the difference between the value of production and therefore the demand and cost of production inputs. Profits are allocated directly to households. The distinction between households that benefit and those that do not is made in the micro-simulation model. Given the limited information available to calibrate the imperfect competition, we followed the literature on the subject to set the value of our settings and perform sensitivity testing of our results to the initial value of sur-profits and scale parameters. The value of the parameter is available in Appendix E.

The model is applied to the data of the SAM in Niger in 2004. The agriculture sector is disaggregated into food and cash crops in order to target food goods that were subject to a rise in imported prices in 2008. So-called food crop products (millet, rice, and corn) are domestic and imported and are not exported. The agricultural products known as cash crops are domestic and exported (souchet, groundnuts, cotton, sesame and onions). Ninety-six percent of the food products available in the economy are used as final consumer goods. The use of food products as inputs exists in food agriculture, in agribusiness and in services.

Table 1: Structure of Agriculture in Niger

	Subsistence Farming	Cash Crop	Agri-Food
Value Added / GDP	13.23%	13.69%	9.29%
Export / Production	0%	34.53%	1.03%
Import / Composite	12.41%	24.24%	17.08%
Value Added/ Production	91.20%	85.05%	43.36%

Source: Author calculating based on SAM database in Niger in 2004.

3.2. The assumption of imperfect competition in the micro-simulation model

The micro-simulation model is a "Top Down" model according to Chen and Ravallion (2004). The model is calibrated on the household survey data to Niger in 2005 (QUIBB_2005). The study requires

this time to identify the merchants in our database and those with the characteristics to be in a position to hold profit.

In the database, merchants[8] represent 13.9% of the population. 60.3% of merchants are poor, 11.6% live in Niamey, 16.4% in other urban areas and 71.9% in rural areas. 64.6% of the poor live in rural areas. Among urban, 68.0% of merchants are self-employed, 17.3% are employed and 1.3% are employers. Among rural merchants, 98.31% are self-employed.

As marketing service sector is in a market power situation, some merchants receive, from the initial situation, some of the sur-profit. Households benefiting from the sur-profit are supposed to be non-poor households in urban areas where the head has a merchants' activity and is an employer. This corresponds to six households in the database, eventually all living in Niamey that is to say 0.7% of urban merchants.

In the initial situation, with no distinction in the household survey between profit and return on capital, profit is considered included in the return on capital. According to the simulations, the number of firms in market power situation varies in the CGE. These changes are reflected in the household model via the number of households receiving profit. Households not benefiting from the super-profit after simulation are determined by a random drawing in the following their socio-economic characteristics (similar to that used for the supply of labor). The model considers for exits, a variation of profit of -100%. For firms experiencing remaining market power, the profit rate of change is determined by the rate of change of the capital remuneration of the sector.

In order to facilitate analysis, six household groups are identified according to two criteria[9]: area of residence (urban, rural) and the main activity of household head (farmers and non-farmers, merchants). The six groups analyzed so are the urban farmers (Uagr), the rural farmers (Ragr), urban non farmers (Unagr) and rural non-farmers (Rnagr) urban merchants (Ucom), rural merchants (Rcom). For each group, the average structure of expenditure and income is presented in Appendix G and H. The density curves for each group are available in Appendix I.

[8] Households whose the head has a trading activity represents 16.73% of households. With the level-headedness, it represents 13.9% of the Nigerien.

[9] The breakdown of household is independent from the CGE. It is made by taking into account the information provided in the QUIBB database and changes can be made without changing the CGE or the micro-simulation model.

Table 2 : Constitution of the six household groups

		Household group	Individual	Part
1	Uagr	Urban Farmers	386 388	3.1%
2	Ragr	Rural Farmers	7 949 999	63.0%
3	Unagr	Urban non-farmers	1 238 715	9.8%
4	Rnagr	Rural non-farmers	1 301 850	10.3%
5	Ucom	Urban merchants	491 193	3.9%
6	Rcom	Rural merchants	1 258 918	10.0%
		Total	12627063	100.0%

Source: Author's calculating based on the QUIBB database_2005.

4. Presentation of simulations and results

The aim of this work is to know if VAT and Trade tariffs exemptions can fight against poverty when world prices of imported food products increases by 70% when there is a market power for merchants, and considering that VAT is not only a tax on final consumption goods. The simulations are summarized in Table 3 as below.

4.1. Presentation of simulations

In the SAM in Niger in 2004, very little VAT is collected on food crops because of non-compliant of producers and many exemptions from VAT during the scope of the construction of the database. For purposes of simulations, we have constructed a baseline including a widening of 30% of the VAT base for a given proportion of producer not compliant to VAT. The results of the whole simulations are compared to this new baseline. The first simulation reproduces the impact of the 70% increase in the world price of food imports as in Boccanfuso and Savard (2011). Simulation 2, considers that the increase in the world price of food imports is associated with a total exemption from VAT on these same goods. In simulation 3, the increase in world prices is this time compensated by a decrease in customs duties on these same agricultural goods.

For the first two simulations, the temporary context of the shock allows us to consider that the change in the level of public revenue is reflected, for a constant level of public expenditure, in the level of public savings. Public debt increases and public services remain constant. For the last two simulations, the loss of public revenue generated by the fiscal policies to combat the surge in agricultural prices is set at the same amount. Thus, the results in terms of poverty can be compared between simulations.

Given the role of the substitution elasticities of the Armington function (de Melo and Robinson, 1989), sensitivity tests have been carried out and do not alter the order of the results concerning the

fiscal policy most likely to protect the poor population from an increase in the world prices of agricultural goods[10].

Table 3: Summary of simulations

Public revenue closure: exogenous tax rate, endogenous public Recipe	
Simulation 1	Increase of world imported a food crop prices of 70%
Simulation 2	Increase of world imported food crop prices of 70% Customs duties suspension on food crop goods
Public revenue closure: endogenous tax rate, exogenous public Recipe egal to simulation 2	
Simulation 3	Increase of world imported food crop prices of 70% VAT exemptions on food crop goods.

4.2. Macroeconomic impact of tax exemptions

The results of these simulations provide a better understanding of the influence of a rise in the world price of imports and of tax exemptions on the allocation of the economy's resources in a country such as Niger. For each simulation, particular attention is paid to the evolution of the market structure among merchants. The main macroeconomic results are given in Table 4 below, and the sectoral results in Annexes J and K.

Macroeconomic effects of the increase in the world price of agricultural imports (simulation 1)

The rise in the world price of imports of food-producing agricultural goods leads to a loss of price competitiveness of imports in relation to domestic production. The demand for imported goods is declining (-45.49%) in favor of domestic production (+7.85%). The increase in demand for domestic food-producing goods drives up the domestic price of food crops. The increase in the domestic price is reflected in the selling price of farmers in the sector (+0.57%). There is therefore a transmission of prices between world prices, domestic prices and producer prices as presented in the country's statistics in 2008.

The composite price of goods is a weighted average of the import price and the domestic sales price. This average price depends on the respective shares of imports and domestic products in the domestic consumption of the product concerned. Since the surge in world prices leads to an increase in the price of imports and to a lesser extent of domestic sales, and since demand is satisfied mainly by domestic production, the composite price of agricultural goods increases but less than the increase in the world price. This increase in the composite price of food crops has repercussions throughout the economy by increasing the price of agricultural goods: final consumer goods, inputs and capital goods.

[10] The elasticities that are used in this situation are available in Appendix F.

The driving force behind production decisions is the value-added price (i.e. the difference between the selling price received by the producer and the unit cost of intermediate consumption). The producers' selling price increases, driven by the demand for domestic goods. The demand for intermediate goods is linked to the volume of production in each sector by a fixed coefficient (Leontief function). The increase in the price of inputs due to the rise in the world price therefore does not modify the demand for intermediate goods but mitigates the positive effects of the rise in the selling price of farmers. The price of value added still increases in food-producing agriculture (+0.52%) but less than the producers' selling price (+0.57%).

Sectoral demand and value-added prices remunerate the factors of production. Capital and labour are mobile in this version of the model. The increase in the value-added price of food agriculture leads to an increase in the demand for unskilled labor, the main factor of production in this sector. Thus, the equilibrium between supply and demand is achieved through an increase in the remuneration of unskilled labor (+0.51%). The increase in the rate of remuneration of factors remains nevertheless lower than the increase in the price of value added, which allows an increase in the production of food products (+7.85%). Thus, the increase in world prices benefits the development of local production of food crops.

Food crop agriculture is used as an input in three sectors: food processing mainly but also food crop agriculture itself, and services. Thus, the increase in the price of agricultural inputs has repercussions on the production costs of other sectors, which, combined with an increase in the remuneration of unskilled labor and capital, leads to an increase in the selling price of production. The increase in the selling price of goods produced by these sectors in turn leads to higher production costs in related sectors and an increase in their selling price. The selling price of production increases slightly more than that of intermediate consumption but is not sufficient to compensate for the increase in factor compensation (labor and capital). There is thus a decline in production in the private sectors outside food-producing agriculture. The contraction of production in these sectors frees up skilled labor and leads to a decrease in its rate of remuneration (-0.79%).

The rise in the composite price leads to an increase in consumer prices simultaneously with changes in factor compensation. Through income and consumer price effects, the rise in world prices affects households differently depending on the structure of their income and consumption, which will be studied in the following section using the micro simulation model. Aggregated, the price effect outweighs the income effect, which leads to a decrease in the demand for final consumer goods.

The rise in world prices leads to a fall in customs revenue (despite the price rise, there is a significant contraction in the tax base) which, despite the slight increase in domestic revenue, leads to a loss of tax revenue (-0.5%). For a constant level of public expenditure, the loss of tax revenue leads to a decrease in public savings, the main constraint on demand for capital goods. Total investment is pulled

down (-0.3%). Associated with the rise in the composite price of goods, the demand for capital goods (industrial goods) declines.

This change in the demand for final consumer goods and capital goods is reflected in the demand for sectors other than food-producing agriculture. Thus, the rise in the price of food imports has a positive knock-on effect on local food production but leads to a drop in production for all other market sectors of the economy.

What is the role of merchants in determining domestic prices? The composite price of the good charged locally is increased by the amount of the trade margins. The value of the trade margin depends on the amount of service needed to market the good demanded (assumed to be proportional to demand) and its price. The increase in the world price of agricultural imports leads to a decrease in the demand for the composite good. In pure and perfect competition, the selling price of the trade service depends solely on the marginal cost of production of the industry. On the other hand, under the hypothesis of an oligopolistic market, as is the case here, the price of the trade service always depends on the rate of remuneration of the factors but also on the evolution of the margin rate of the firms present on the market. Here, the increase in the world price leads to an increase in fixed costs (via an increase in the return on capital) and a decrease in the number of firms on the market. In fact, the margin rate of the remaining merchants increases, which reinforces the increase in the sales price of the trade services. Thus, taking into account in the model commercial intermediaries in an oligopolistic situation reinforces the effect of the increase in the world price on domestic prices compared with a situation of pure and perfect competition. The increase in the world price then leads to a loss of efficiency in the production of the trade service (moving away from the situation of perfect competition).

Macroeconomic effects of the decrease in tariff rates (simulation 2)

Compared to previous simulations, the elimination of Trade tariffs applied to the prices of food imports mitigates the increase in the local price of imports (+32.29%). This phenomenon has two types of repercussions: an effect on demand by absorbing part of the increase in the composite price of agricultural goods (+3.80% instead of +7.02% in simulation 1) regardless of their use in the economy (intermediate goods, capital goods, final goods) and this for all economic agents, and an effect on supply, by reducing the price competitiveness of domestic production vis-à-vis imports from the rest of the world.

The reduction of the Trade tariff makes it possible to absorb part of the increase in the world price on the local price of imported goods. Demand continues to be passed on to domestic production (+4.30%) but to a lesser extent than in the previous simulation. The decrease in demand for domestic products implies a drop in the selling price of food producers (-0.51%). Although the decrease in Trade tariffs also concerns agricultural inputs, the decrease in the selling price of producers is not compensated

by a sufficient decrease in the price of inputs. The price of value added decreases (-0.56%) as does the remuneration of unskilled labor (-0.58%) and capital (-28%). The decline in the remuneration of unskilled workers is such that food-producing agriculture can increase its production despite the reduction in the domestic selling price. The development of the agricultural sector (+4.30%) is nevertheless less important than in the previous simulation without government intervention (+7.85%).

By reducing the price of imports and thus the composite price of the good, customs exemptions mitigate the increase in consumer prices of food products compared to Simulation 1 (+3.04% instead of +7.02% in Simulation 1). The price of other consumer goods decreases. Thus, despite the decrease in factor income, household final consumption decreases less than without government intervention. Exemptions from customs duties then allow, despite a negative income effect for the consumer, a support of domestic consumption.

Trade tariffs exemptions lead to a drop in public revenue (-5.00%) and therefore (assuming unchanged public expenditure) in public investment and total investment (-6.13%). Lower demand for capital goods leads to a reduction in the selling price of industrial production. The other private sectors benefit from lower prices of their imported agricultural inputs. However, this is not enough to compensate for the fall in the selling price of goods producers due to the contraction in demand. The price of value added decreases, which reduces the rate of remuneration of skilled labor (-0.58%) and capital (-0.28%). The decrease in factor remuneration is insufficient to increase the production of the sectors. The decline in the domestic price index, on the other hand, allows for an improvement in the price competitiveness of domestic production vis-à-vis the external market. The sale of domestic production is transferred to the external market. Exports fall less than domestic supply.

Government intervention through exemptions from customs duties on food goods leads to a contraction of food-producing activity compared to the rise in the world price of agricultural goods alone, to the benefit of less contraction in other market sectors.

Let us now focus on the effect of customs duties exemptions on the activity of merchants. The decrease in the composite demand for goods leads to a decrease in merchants' activity (-1.43% instead of -1.64% in Simulation 1). In addition, the decrease in the rate of factor remuneration and therefore the marginal cost of production of marketing service sector are favorable to a decline in the price of trade services (-0.56%). The number of firms present on the market decreases and the margin rate increases less than in the previous simulation (+1.73% instead of +1.86% in Simulation 1). The sales price of the trade department decreases and the composite price of the goods, including the sales margin, is lower than in the case of the global price increase alone. Thus, in addition to customs exemptions, the activity of merchants contributes to absorb part of the increase in the world price of food products.

Macroeconomic effects of VAT exemptions in the face of soaring agricultural prices (simulation 3)

Unlike customs duties exemptions, VAT exemptions apply similarly to imported and domestic goods. Customs duties influence the prices of imported goods regardless of their use in the economy, while VAT exemptions influence the price of final consumer goods and also the tax burden of certain producers.

VAT exemptions reduce consumer prices by absorbing part of the increase in world prices (+4.05% instead of +7.02% in simulation 1). This measure supports the demand for food products in relation to the increase in world prices alone (demand for composite goods falls by -2.20% in Simulation 1 compared to -1.20% in Simulation 3). The increase in the world price is such that demand is shifting to domestic production. The domestic price rises (+1.49%), to a greater extent than with the rise in the world price alone (+0.57% in Simulation 1) and the opposite of the effect induced by customs duties exemptions (-0.51% in Simulation 2). The increase in the domestic price has repercussions on the selling price of domestic producers and on the composite price of food products (+9.29%) but not entirely on the consumer price (+4.05%) because of the exemptions.

The narrowing of the VAT base also has implications at the level of the production system by modifying the VAT burden borne by food producers. With the exemptions applied to food crops, VAT non-compliant producers lose the possibility of generating a margin by aligning themselves with the VAT-inclusive price of taxable producers, but benefit from a reduction in the VAT burden on agricultural inputs by using inputs that are now VAT-exempt. VAT compliant producers, for their part, lose the possibility of being reimbursed for the VAT paid on their inputs. On average, VAT exemptions result in an increase in production costs borne by food producers far greater than customs exemptions. The evolution of the value-added price depends on the ratio between the increase in the producers' selling price and the unit cost of production. In food-producing agriculture, the value-added price (+0.79%) is increasing, driven by the rise in producers' selling prices. The demand for unskilled labor in agriculture drives the rate of remuneration of unskilled labor (+0.75%) and the supply of labor in the economy. The rate of return on capital also increases (+1.2%). Thus, the sector's production increases (+8.78%) more strongly than with the rise in world prices alone (+7.85%) and the fall in customs duties (+4.30%).

For the same level of public revenue as in Simulation 2, total investment decreases (-5.32%) less than in Simulation 2 (-6.13%) due to an increase in private savings, which is favorable to the demand for industrial goods. In addition, the increase in factor income contributes to a support of household demand for final consumption goods excluding food products compared to the other simulations. Thus, the selling price of non-food crop producers is higher than in the previous simulation and benefits from an increase in the value-added price in these sectors. Nevertheless, the rate of remuneration of factors (skilled and unskilled labor and capital) increases in such a way that the increase in the price of value

added is insufficient to allow an increase in production in all market sectors other than food-producing agriculture. There is a greater contraction of economic activity in the sectors outside food-producing agriculture than in the case of the reduction in customs duties.

VAT exemptions do help to absorb part of the increase in the world price of food goods for the final consumer. However, it is important to note that this also allows a higher increase in the margin rate of merchants (+2.10%) than in the presence of customs duties exemptions (+1.73%) and without government intervention (+1.86%). The selling price of the trade service increases and the composite price of goods including the trade margin is higher than in the case of the increase in the world price alone or in the case of customs duties exemptions. VAT exemptions strengthen the market power of merchants to the detriment of government revenues and a greater drop in consumer prices.

In the light of the simulations carried out, the rise in world prices can be mitigated at the level of consumer prices by tax measures such as trade tariffs exemptions or VAT exemptions. The effect nevertheless passes through very different channels. The reduction in the rate of Trade tariffs allows a greater absorption of the rise in world prices via a sharp reduction in composite prices before VAT. This is to the detriment of domestic agricultural activity and a decline in the remuneration of factors of production. Government action in terms of customs duties exemptions also forces merchants to reduce their margin rate. VAT exemptions do not change the degree of protection of domestic production in relation to imports. There is an increase in the demand for domestic goods and thus in the selling price of producers. Thus, despite an increase in production costs in the food-producing sector, there is an increase in agricultural production and an improvement in the factor compensation of unskilled workers. Consumer prices are still rising less than with the rise in world prices alone but more than with customs duties exemptions. VAT exemptions allow an increase in the margin rate and the market power of merchants.

Comparing the distributive impact of each policy requires taking into account the price effect and the income effect of each measure through the micro-simulation model.

Table 4: Main macroeconomic results pour every simulation[11]

Variables	Unit	Reference	sim1	sim2	sim3
Simulation's parameters for agricultural goods only					
World price of imports	Parameters	1	1.7	1.7	1.7
VAT exemptions	Pourcentage	70	70	70	100
VAT nominal rate	Pourcentage	19	19	19	19
Custom duties	Pourcentage	28	28	0	28
Remuneration of production's factors			*(% of variation)*		
Capital remuneration	Parameters	0.99	0.6	-0.28	1.2
Skilled people salary	Parameters	1.01	-0.79	-1.43	-1.36
Unskilled people salary	Parameters	0.5	0.51	-0.58	0.75
Public revenue			*(% of variation)*		
Public Revenue (YG)	Billion FCFA	283.27	-0.5	-5	-5
Public Saving	Billion FCFA	-14.58	-15.99	-28.74	-28.74
VAT Revenue (VAT)	Billion FCFA	86.74	0.31	-0.56	-13.59
Duty Revenue (TIM)	Billion FCFA	94.18	-1.5	-14.03	-2.08
Variables	**Unités**	**Reference**	**sim1**	**sim2**	**sim3**
Public revenue				*(in %)*	
VAT/YG	Pourcentage	30.62	30.87	32.05	27.85
VAT/GDP	Pourcentage	5.21	5.23	5.19	4.5
TIM/GDP	Pourcentage	5.66	5.57	4.87	5.54
YG/GDP	Pourcentage	14.04	13.95	13.2	13.18
Macroeconomic Indicators			*(% of variation)*		
Total Investment	Billion FCFA	244.68	-0.3	-6.13	-5.38
Gross Domestic Product (GDP)	Billion FCFA	1664.45	0.04	-0.07	0.07
Imperfect Competition in Business Branch			*(% of variation)*		
Mark up Rate	Billion FCFA	0.11	1.86	1.73	2.1
Retailer's profit	Billion FCFA	16.86	1.34	0.38	2.04
Number of retailers	Parameters	9.35	-1.82	-1.7	-2.05
Marginal cost of production In the business branch	Parameters	0.89	0.42	-0.55	0.62

Source: Results of the CGE based on SAM database in 2004 and following the author's hypothesis.

4.3. Tax exemptions and protection of the poor

The reference situation takes into account a 30% widening of the VAT base compared to the calibration of the model on the SAM data. Distributive analysis is used to study the incidence (FGT0), depth (FGT1) and severity (FGT2) of poverty. The poverty line used is 105,827 FCFA per year and per

[11] The reference situation was built for simulations. The baseline reflects a broadening of 30% of the VAT base relative to the initial calibration of the model based on SAM database. Segment results are available in Appendix J and K.

capita in rural areas and 144,750 FCFA in urban areas (QUIBB_2005). The poorest households are those deriving their income from agriculture, regardless of their place of residence and for the same sector of activity, households living in rural areas are poorer than those living in urban areas.

Table 5: Indices of poverty and inequality in Niger.

	Niger	Urban Farmers	Rural Farmers	Urban non Farmers	Rural non Farmers	Urban Merchants	Rural Merchants
% population		3%	63%	10%	10%	4%	10%
Incidence (FGT_0)	63.0	72.8	70.2	38.2	60.0	35.1	52.1
Depth (FGT_1)	26.3	31.6	30.7	13.3	24.7	9.8	18.4
Severity (FGT_2)	13.8	16.7	16.5	6.3	12.8	3.4	8.8
Gini	0.47	0.41	0.43	0.43	0.45	0.44	0.40

Source: Author's calculating based on DASP Package with QUIBB database_2005.

Methodological rigor requires that only the poverty results deduced from the budget-neutral simulations be compared, since the welfare effect of a change in government revenue is not taken into account in the micro-simulation model. Simulation 1 is presented with the aim of identifying the households most vulnerable to the increase in the world price of food imports.

In terms of poverty incidence, a 70% increase in the world price of agricultural goods leads to an increase in national poverty. Exempting food-producing agricultural goods from VAT makes it possible to reduce the incidence (FGT0), severity (FGT1) and depth (FGT2) of poverty caused by the increase in the world price (respectively 0.97; 0.57; 0.48) of food products to a greater extent than customs exemptions (respectively 0.67; 0.40; 0.33).

Changes in prices and factor compensation have different impacts on each group of households. This impact depends on the structure of their income and expenditure. Contrasting effects emerge depending on the group and the tax measure implemented. The variation in the FGT indices compared to the baseline situation is available in Appendix L (values and significance).

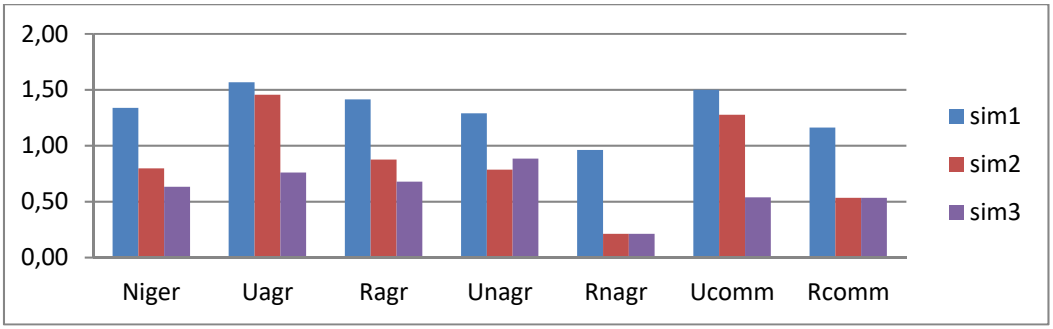
The net effect of the increase in the world price in terms of poverty depends on the capacity of domestic agricultural production, driven by the increase in the world price, to generate sufficient income (the rate of remuneration of unskilled workers increases as well as the rate of remuneration of capital) to compensate for the increase in consumer prices. The incidence of poverty increases more for urban farming households, followed by urban merchants and then rural farmers. On the other hand, regardless of the activity of the head of household, the depth and severity of poverty increases more among rural households, especially farmers.

Exempting food products from customs duties (simulation 2) leads to a reduction in the rate of remuneration of factors (capital and labor) and makes it possible to absorb part of the increase in world prices on the consumer price level of food products. The incidence of poverty decreases for all households compared to the previous simulation and especially for rural households not working in agriculture (10% of the total population and 3rd poorest group). Rural farmers also benefit from the measure, suggesting that the price effect is greater than the income effect for this group of households. Urban merchants, including households in a position of market power, benefit least from this tax measure (loss of profit).

VAT exemptions (simulations 3) lead to an increase in the rate of return on capital and unskilled labor, in contrast to the reduction in Trade tariffs. Compared to the decrease in Trade tariffs, the incidence of poverty decreases more sharply for all households except urban non-farming households. Merchants living in urban areas are those who benefit the most from the measure. Indeed, merchants benefit from support for the demand for agricultural goods due to a strict link between local demand for goods and trading activity and via an improvement in the branch's profit, which is favorable to an increase in the income of households whose head is a merchant in a position of market power.

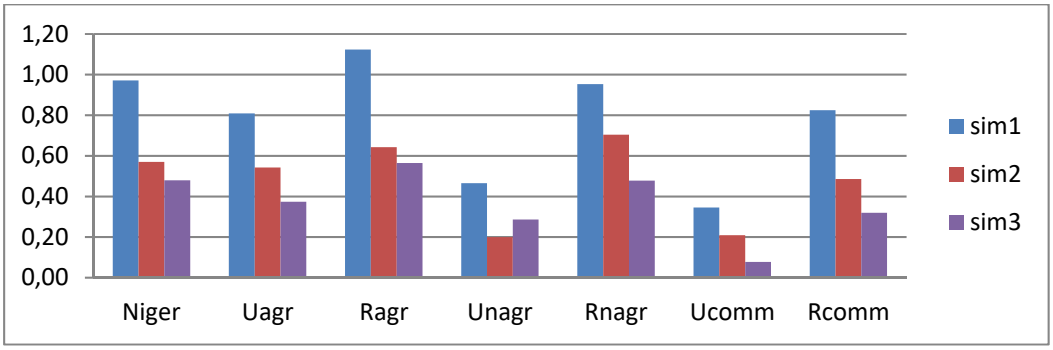
At the global level, VAT exemptions are more effective than Trade tariffs exemptions in limiting the effects of the rise in world prices on poverty. At the group level, the evolution of the three poverty indexes points in the same direction. All groups of households benefit more from Trade tariffs exemptions than from VAT exemptions, except for non-farming urbans. It is important to note that urban merchants with market power are the group of households benefiting the most from VAT exemptions.

Figure 1 : Variation in the incidence of poverty



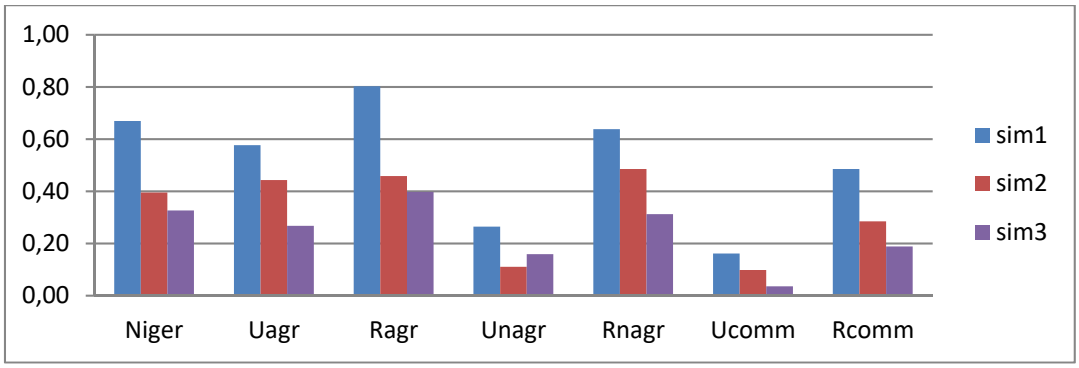
Source: Authors' calculations, results of the micro simulation on DASP. Cf. appendix **Erreur ! Source du renvoi introuvable.**.

Figure 2 : Variation in the depth of poverty



Source: Authors' calculations, results of the micro simulation on DASP. Cf. appendix **Erreur ! Source du renvoi introuvable.**.

Figure 3 : Variation in the severity of poverty



Source: Authors' calculations, results of the micro simulation on DASP. Cf. appendix **Erreur ! Source du renvoi introuvable.**.

5. Conclusion

The objective of this paper was to compare the impact of the tax policies implemented by governments in the context of a surge in the international prices of agricultural goods, in terms of economic efficiency as well as the fight against poverty. Compared to the literature, the model used to compare these tax policies brings two innovations: the modeling of VAT (which is certainly a tax on final consumption but also a tax on inputs for some producers) and the introduction of the market power of merchants in the question of the impact of tax policies.

In Niger, with the aim of reducing the effect of the rise in world prices on consumer prices, the government is introducing temporary exemptions to limit the rise in consumer prices. Our results show that, for the same level of government revenue, VAT exemptions promote a better allocation of resources than Trade tariffs exemptions. In low-input-using economies, VAT exemptions do not result in a sufficiently high tax burden for domestic producers to be unfavorable to domestic production, while lower customs duties increase the competitiveness of agricultural imports that are unfavorable to domestic production. The effect of VAT exemptions on domestic production could be different in a more industrialized economy with higher demand for inputs. The fears associated with VAT from the producer or consumer point of view must then be put into a specific economic context.

The results also teach that VAT exemptions strengthen the market power of merchants in oligopolistic situations. Thus, although households living in rural areas (63% of the total population, the second poorest group) earn more from VAT exemptions than from customs duties exemptions, it is interesting to note that part of the measure benefits merchants in a situation of market power even more, at the expense of a greater reduction in consumer prices and a significant tax expenditure.

6. References

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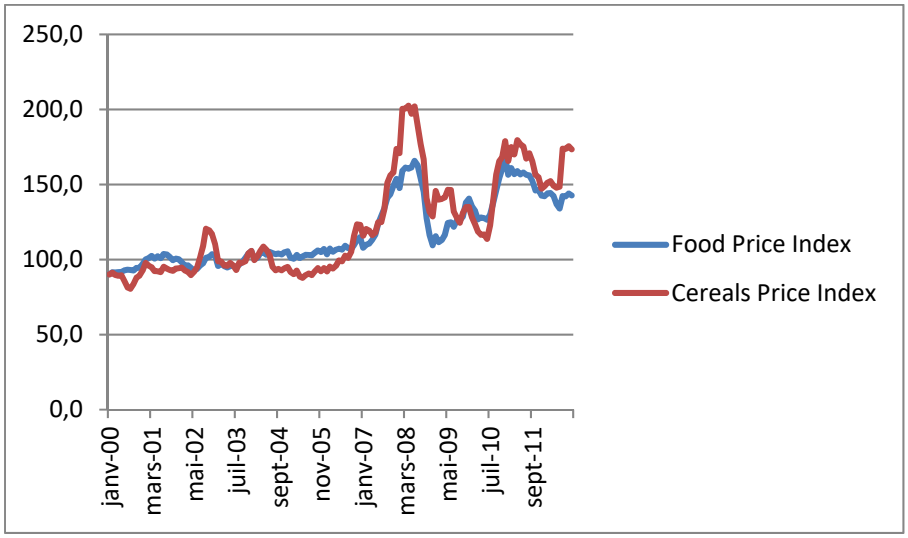
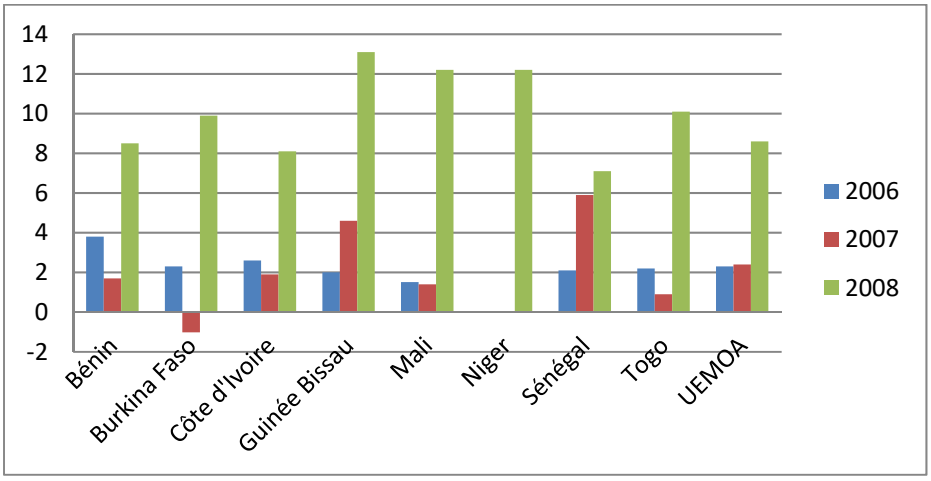
7. Appendix

A. World food Price Index and Cereals price Index between 2000 and 2012



Source: FAO.

B. Harmonized inflation rates (%) in the West African Economic and Monetary Union countries



Source: ANSD (2008) et Afristat

C. VAT and import duties Exemptions

	Number of Countries	Tax reductions				Year of reduction		Countries w/changes	Percent of countries
		Import	VAT	Sales	Excise	2007	2008		
Income group									
High-income OECD	18	17	0	0	0	16	1	17	94
High-income non-OECD	15	5	1	0	0	4	1	5	33
Upper-middle income	49	20	10	2	0	7	19	23	47
Low er-middle income	43	19	4	1	1	10	14	19	44
Low -income	34	15	7	0	0	12	10	20	59
Net total food trade balance									
Large importer	19	10	5	1	1	4	9	12	63
Small importer	99	47	12	1	0	32	24	28	28
Small exporter	28	15	4	0	0	11	7	9	32
Large exporter	13	4	1	1	0	2	5	6	46
Net cereal trade balance									
Large importer	104	46	16	3	1	21	37	51	49
Small importer	38	20	3	0	0	21	2	22	58
Exporter	17	10	3	0	0	7	6	11	65
All Countries	159	76	22	3	1	49	45	84	53

Sources: IMF (2008a).

Note: Large food importer: net imports greater than 3 percent of GDP; large food exporter: net exports greater than 4 percent of GDP; large cereal importer: net imports greater than 0.2 percnt of GDP.
The count for total changes may differ from the sum of 2007 and 2008 because the same country may have tax changes in both years.

D. Imperfect competition equations

- Retailer production sector

$$XS_{com} = \sum_{inc} MG_{inc} * Q_{inc}$$

Com	*Retailor sector*
inc	*Non retailor sectors*
XS_{com}	*Production*
MG_{inc}	*Demand of marketing service by the other sectors*
Q_{inc}	*Composite demand*

- Selling price, market margin included

$$PVM_i = PQ_{inc} + (MG_{inc} * P_{com} * (1 + (tcn_{com} * (1 - exo_{com}))))$$

PVM_i	*Selling price, market margin included*
MG_{inc}	*Demand of marketing service by the other sectors*
P_{com}	*Producer price*
PQ_i	*Composite price*

- Lerner Index

$$\frac{P_{com} - Cma_{com}}{P_{com}} = markup_{com} \;\; ; \;\; markup = -\frac{1}{Nent_{com} * \varepsilon^d_{com}}$$

P_{com} *Producer price*
Cma_{com} *Marginal production cost*
$markup_{com}$ *Mark up rate*
$Nent_{com}$ *Number of identical firms in marketing service sector*
ε_{com}^{d} *Price elasticity of demand*

$$CT_{com} = SS_{com} * LD_{com} + R_{com} * KD_{com} + \sum_{\mathrm{j}}\left(\mathrm{DI_{j,com}} * \mathrm{NASS_{com}} * (1 - \mathrm{exon_j}) * \mathrm{PVM_j} * (1 + tcn_j)\right) + \sum_{\mathrm{j}}\left(\mathrm{DI_{j,com}} * \mathrm{NASS_i} * \mathrm{exon_j} * \mathrm{PVM_j}\right) + \sum_{\mathrm{j}}\left(\mathrm{DI_{j,com}} * (1 - \mathrm{NASS_{com}}) * (1 - \mathrm{exon_j}) * \mathrm{PVM_j} * (1 + tcn_j)\right) + \sum_{\mathrm{j}}\left(\mathrm{DI_{j,com}} * (1 - \mathrm{NASS_{com}}) * \mathrm{exon_j} * \mathrm{PVM_j}\right)$$

CT_{com} *Total cost*
SS_{com} *Composite wage*
R_{com} *Capital rate of return*
KD_{com} *Total capital demand*
$DI_{j,com}$ *Intermediate consumption of good i by merchants*
$NASS_i$ *Non-liable production*
$exon_j$ *Exempted goods*
PVM_j *Selling price, market margin included*
tcn_j *Nominal rate of VAT*

- Return to scale :

$$\mathrm{VA_{com}} = \mathrm{aa_{com}} * \mathrm{LD_{com}}^{\alpha_{com}} * \mathrm{KDV_{com}}^{1-\alpha_{com}}$$

VA_{com} *Value added*
aa_{com} *Scale factor in value added function*
LD_{com} *Composite labor demand*
KDV_{com} *Demand of variable capital*
α *Scale parameter*

$$AC_{com} = Cma_{com} + \left(\frac{R_{com} * KDF_{com}}{XSF_{com}}\right)$$

AC_{com} *Average cost*
Cma_{com} *Marginal cost*
R_{com} *Capital rate of return*
KDF_{com} *Fixed capital*
XSF_{com} *Firm production*

$$KDV_{com} = KD_{com} - Nent_{com} * KDF_{com}$$

KDV_{com} *Variable capital*
KD_{com} *Total capital*
$Nent_{com}$ *Number of identical firms in marketing service sector*
KDF_{com} *Fixed capital*

$$XSF_{com} = \frac{XS_{com}}{Nent_{com}}$$

XSF_{com} *Firm production*

$Nent_{com}$ *Number of identical firms*
XS_{com} *Production*

$$PS_{com} = \frac{AC_{com}}{Cma_{com}}$$

PS_{com} *Scale elasticity*
AC_{com} *Average Cost*
Cma_{com} *Marginal Cost*

$$PR_{com} = PV_{com} * VA_{com} - SS_{com} * LD_{com} - R_{com} * KD_{com}$$

PR_{com} *Merchant profit*
PV_{com} *Value added price*
VA_{com} *Value added*
SS_{com} *Composite wage*
LD_{com} *Composite labor demand*
R_{com} *Capital rate of return*
KD_{com} *Total capital demand*

E. Parameter used in the model

Fixed Capital (% of total capital)	40%
Number of firms	9,30
Scale Elasticity	1,041
Mark up rate	0,11
Domestic price elasticity of demand faced by the retailer	1

F. Elasticities used in the Model

	Food Crop	Cash Crop	Livestock	Agribusiness	Industry	Private Services	Public Services
Sigmar	0,97	1,09	1,07	1,07	0,56	1,33	1,06
Sigmal	1,2	1,2	1,2	1,2	1,2	1,2	
Sigmava	0,8	0,8	0,8	0,8	0,8	0,8	0,8
Sigmam	1,3	1,3	1,3	1,3	0,8	1,3	
Sigamae	1,2	1,2	1,2	1,2	1,1	1,3	

Sigmar: Revenu Elasticity; 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).

G. Expenditure patterns of households in Niger

Group	Niger	Uagr	Ragr	Unagr	Rnagr	Ucomm	Rcomm
Population share	100%	3%	63%	10%	10%	4%	10%
Food Crop	40%	31%	48%	22%	43%	24%	41%
Cash Crop	5%	5%	4%	5%	5%	5%	5%
Livestock	11%	12%	11%	12%	12%	12%	12%
Agribusiness	11%	13%	11%	13%	12%	12%	13%
Food Expenditure	*66%*	*61%*	*64%*	*51%*	*72%*	*53%*	*71%*
Industry	13%	14%	13%	14%	12%	13%	13%
Private Services	9%	14%	4%	18%	6%	19%	6%
Public Services	4%	4%	3%	7%	3%	5%	3%
Taxes	2%	4%	1%	5%	1%	5%	0%
Saving	6%	4%	5%	6%	6%	6%	6%
Total	100%	100%	100%	100%	100%	100%	100%

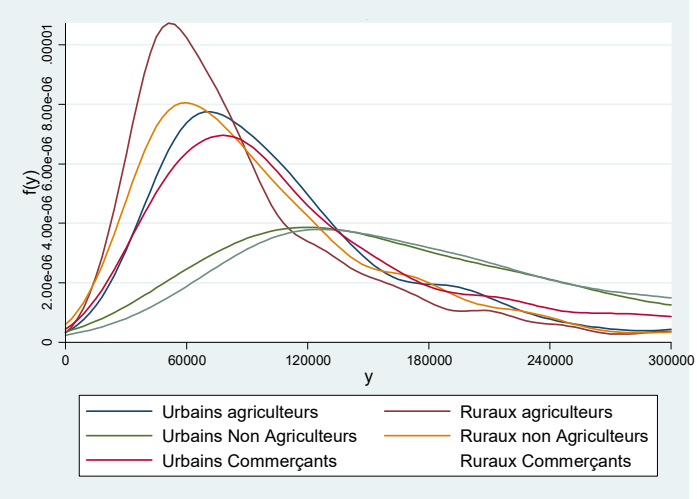
Source: Authors' calculations based on data from the QUIBB_2005.

H. Revenues patterns of households in Niger

Group	Niger	Uagr	Ragr	Unagr	Rnagr	Ucomm	Rcomm
Population share	100%	3%	63%	10%	10%	4%	10%
Non-qualified Labor	38%	64%	40%	23%	39%	46%	43%
Qualified Labor	4%	0%	0%	19%	1%	8%	1%
Public Labor	5%	0%	0%	22%	13%	0%	0%
Capital	20%	21%	17%	11%	18%	39%	35%
Self-Consumption	24%	14%	34%	6%	28%	7%	21%
Transfers	9%	1%	9%	19%	1%	0%	0%
Total	100%	100%	100%	100%	100%	100%	100%

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

I. Density Curve of households' revenue



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

J. Sectorial Variations for Each Simulation

			Variations (%)		
Variables	Sectors	Baseline	sim1	sim2	sim3
Production (XS)	Food Crop	290.38	7.85	4.30	8.78
	Cash Crop	102.13	-2.32	-0.29	-1.93
	Livestock	304.72	-1.76	-1.20	-1.69
	Agribusiness	206.62	-1.86	-0.84	-1.24
	Industry	417.14	-1.37	-1.07	-3.33
	Private Services	475.70	-1.57	-1.04	-1.21
	Public Services	255.89	-0.26	0.05	-0.25
	Retailers	198.66	-1.64	-1.43	-1.49
Final good demand (CF)	Food Crop	32467.68	-2.28	-1.33	-1.27
	Cash Crop	6339.97	-1.69	-0.97	-0.94
	Livestock	19076.05	-1.70	-0.96	-0.95
	Agribusiness	18139.23	-1.68	-1.00	-0.90
	Industry	24081.62	-0.85	-0.52	-0.44
	Private Services	28318.84	-2.10	-1.21	-1.14
	Public Services	1823.96	-1.60	-1.03	-0.82
Composit demand (Q)	Food Crop	330.58	-2.20	-1.29	-1.20
	Cash Crop	89.43	-1.76	-0.93	-1.08
	Livestock	251.24	-1.63	-1.35	-1.49
	Agribusiness	246.04	-1.70	-0.99	-1.02
	Industry	602.64	-0.74	-2.10	-2.34
	Private Services	475.06	-1.56	-1.05	-1.20
	Public Services	255.89	-0.26	0.05	-0.25
	Retailers	198.66	-1.64	-1.43	-1.49
Domestic demand (DD)	Food Crop	290.38	7.85	4.30	8.78
	Cash Crop	68.52	-2.03	-0.63	-1.48
	Livestock	250.38	-1.63	-1.34	-1.49
	Agribusiness	204.49	-1.85	-0.85	-1.24
	Industry	242.02	-1.05	-1.61	-2.82
	Private Services	471.91	-1.56	-1.05	-1.20
	Public Services	255.89	-0.26	0.05	-0.25
	Retailers	198.66	-1.64	-1.43	-1.49
Imports (M)	Food Crop	40.39	-45.49	-28.20	-44.37
	Cash Crop	20.93	-1.04	-1.72	0.00
	Livestock	0.85	-0.83	-2.21	-0.28
	Agribusiness	41.60	-1.14	-1.52	-0.23
	Industry	360.72	-0.57	-2.38	-2.06
	Private Services	3.15	-0.93	-1.77	-0.28

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

K. Price Variations for Each Simulation

			Variations (%)		
Variables	Sectors	Baseline	sim1	sim2	sim3
Consumption price (PC)	Food Crop	1.32	7.02	3.04	4.25
	Cash Crop	1.40	0.58	-0.56	0.85
	Livestock	1.12	0.62	-0.63	0.93
	Agribusiness	1.17	0.45	-0.41	0.63
	Industry	1.29	0.25	-0.36	0.39
	Private Services	1.02	0.49	-0.55	0.71
	Public Services	1.04	0.15	-0.14	0.20
	Retailers	1.01	0.64	-0.35	0.87
Selling price (PVM)	Food Crop	1.25	7.02	3.04	7.76
	Cash Crop	1.33	0.58	-0.56	0.85
	Livestock	1.12	0.62	-0.63	0.93
	Agribusiness	1.14	0.45	-0.41	0.63
	Industry	1.19	0.25	-0.36	0.39
	Private Services	1.00	0.49	-0.55	0.71
	Public Services	1.00	0.15	-0.14	0.20
	Retailers	1.00	0.64	-0.35	0.87
Composite price (PQ)	Food Crop	1.02	8.43	3.80	9.29
	Cash Crop	1.05	0.56	-0.61	0.84
	Livestock	1.00	0.62	-0.67	0.94
	Agribusiness	1.05	0.44	-0.41	0.61
	Industry	1.10	0.22	-0.36	0.35
	Private Services	1.00	0.49	-0.55	0.71
	Public Services	1.00	0.15	-0.14	0.20
	Retailers	1.00	0.64	-0.35	0.87
Domestic price (PD)	Food Crop	0.99	0.57	-0.51	1.49
	Cash Crop	0.99	0.77	-0.84	1.16
	Livestock	1.00	0.63	-0.67	0.94
	Agribusiness	1.00	0.56	-0.53	0.78
	Industry	0.99	0.61	-0.98	0.98
	Private Services	1.00	0.49	-0.56	0.72
	Public Services	1.00	0.15	-0.14	0.20
	Retailers	1.00	0.64	-0.35	0.87

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

			Variations (%)		
Variables	Sectors	Baseline	sim1	sim2	sim3
Producer price (PP)	Food Crop	0.99	0.57	-0.51	1.49
	Cash Crop	1.00	0.52	-0.56	0.78
	Livestock	1.00	0.51	-0.55	0.78
	Agribusiness	1.00	0.55	-0.52	0.78
	Industry	1.00	0.35	-0.57	0.57
	Private Services	1.00	0.49	-0.55	0.71
	Public Services	1.00	0.15	-0.14	0.20
	Commerce	1.00	0.64	-0.35	0.87
Value added price (PVA)	Food Crop	1.00	0.52	-0.56	0.79
	Cash Crop	1.00	0.52	-0.57	0.78
	Livestock	1.00	0.52	-0.56	0.79
	Agribusiness	1.00	0.46	-0.62	0.67
	Industry	1.00	0.33	-0.70	0.46
	Private Services	1.00	0.46	-0.60	0.69
	Public Services	1.00	0.05	0.00	0.05
	Retailers	1.00	0.77	-0.30	1.03

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

L. Nominal changes in poverty indices for each simulation

Simulation	FGT Indices	Niger	Uagr	Ragr	Unagr	Rnagr	Ucomm	Rcomm
Population share			*3%*	*63%*	*10%*	*10%*	*4%*	*10%*
Baseline	FGT0	63%	73%	70%	38%	60%	35%	52%
	FGT1	26%	32%	31%	13%	25%	10%	18%
	FGT2	14%	17%	17%	6%	13%	4%	9%
Baseline variations								
Sim1	ΔFGT_0	1.34**	1.57**	1.41**	1.29**	0.96**	1.50**	1.16**
	ΔFGT_1	0.80**	0.81**	1.12**	0.47**	0.95**	0.34**	0.82**
	ΔFGT_2	0.63**	0.58**	0.80**	0.26**	0.64**	0.16**	0.49**
Sim2	ΔFGT_0	0.97**	1.46*	0.88**	0.79**	0.21*	1.28**	0.53
	ΔFGT_1	0.57**	0.54**	0.64**	0.20**	0.70**	0.21**	0.49**
	ΔFGT_2	0.48**	0.44**	0.46**	0.11**	0.49**	0.10**	0.28**
Sim3	ΔFGT_0	0.67**	0.76	0.68**	0.88**	0.21*	0.54*	0.53
	ΔFGT_1	0.40**	0.37**	0.56**	0.29**	0.48**	0.08**	0.32**
	ΔFGT_2	0.33**	0.27**	0.40**	0.16**	0.31**	0.04**	0.19**

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