IMPACTS OF THE DOHA ROUND AND ECOWAS ON THE GUINEA-BISSAU ECONOMY: AN ANALYSIS WITH CGE MODEL

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Abstract: Trade in agricultural products is very sensitive to shocks in world markets. However, just a few decades ago agricultural commodities had their trade regulated, which occurred only in the beginning of the early 2000s, marking the first steps of developing and less developed countries towards the liberalization of their products. This study aims to analyze the proposal of tariff reduction formalized in the Doha agreement on the economy of Guinea-Bissau, contributing to the analysis of trade liberalization and its implications for development, particularly discussing the effects on poverty and welfare. The analysis was conducted by Guinea-Bissau economy-based computable general equilibrium model calibrated with the 2007 data. Large negative short-term impacts in welfare and poverty were attributed to a partial cut in import tariffs (56%). As the effects on the product that the model was able to capture bring an expansion in the cash crops sectors (mainly millet, sorghum, maize and rice) and in some industries and services sectors, the tariff reduction policy could promote the diversification of national production.

Keywords: Trade agreements. Computable General Equilibrium Model. Guinea-Bissau

JEL code: C68; F14; Q17

1. Introduction

Guinea-Bissau is a country with small economy fundamentally based on agricultural production, which accounts for more than 60% of its gross domestic product (GDP) and 90% of its exports. Considering the total of 68% of the population over 15 years employed, 61% corresponds to employment in the agricultural sector, 5.8% industrial employment and 34.1% employment in the services sector (ILO, 2017).

Cashew nuts are the country's main production and export commodity. The boom in the international price of this commodities in 1990 in response to increased demand from Asian countries, such as Singapore and India, has boosted this culture. As a result, the Guinean government has adopted policies to promote the export of agricultural products, since customs revenues from exports contribute between 35% and 40% of total tax revenue generated since 2007 (GUINEA-BISSAU, 2010).

Historically, the production and marketing of traditional agricultural products for

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export in most African countries, in Guinea-Bissau is no different, are controlled by the Government. This is done via subsidies or export quotas, specific regulatory stock programs and actions organized through international commodity agreements (DIAO ET AL., 2007). This State interference has two purposes: to maintain the fiscal balance of public accounts through the revenue generated by export taxes and to ensure the growth and modernization of agriculture so that this sector maintains its share of GDP. In this way, the Government of Guinea-Bissau justifies the strong intervention in the agricultural sector with the purpose of guaranteeing GDP growth, the level of employment and generating revenue for the financing of development policies.

Meanwhile, trade in agricultural commodities depends heavily on how the world market works. However, until the 1990s agricultural goods did not have their international trade regulated by the GATT (General Agreement on Tariffs and Trade), and discussions began on the subject only after the Uruguay Round, when developing and less developed countries were able to take the first steps towards the liberalization of trade in their export products. Agriculture became the focus of discussion only in the Doha round in Qatar in 2001, formally known as Doha Development Agenda (henceforth DDA), where forms of free trade were sought not only for developed countries, but mainly for developing ones exporting agricultural products. A reform program containing support and protection rules was established to correct and prevent restrictions and distortions in world agricultural markets caused by high export subsidies by rich countries (see WTO, 2001). Although the exact degree of tariff reductions and the level of cuts in the distortion of support for agriculture had been left for future negotiations, the Doha round did in fact find some general principles in the so-called July 2004 Package (BOUET ET AL, 2005).

This study is designed to answer the following questions: Is the agreement formalized in the Doha round capable of promoting the performance of the external sector and more generally the development of a small poor country like Guinea-Bissau? What are the mechanisms through which the liberalization of international trade affects the income and investments of the sectors? Does eliminating or reducing tariffs have any redistributive effects that can reduce poverty and increase welfare?

The purpose is to deepen the understanding of how exports react to tariff reduction agreements and how an economic policy based on tariff rates contributes to guiding the development of a small and poor country. This analysis for a small economy receives little attention from the empirical trade literature. The quantitative analysis of the economic consequences of multilateral trade reforms is traditionally carried out from the partial equilibrium perspectives, without much concern for the possible unleashing to other sectors that an economic policy, whether internal or external, is capable of provoking. In doing so, trade literature may be largely ignoring in its analysis indirect distributional effects between sectors of the economy and their importance to a development strategy primarily focused on poverty reduction, providing evidence subject to controversial political opinions than an analysis equilibrium would be able to report

In the last few decades, however, there have been increasing publications evaluating the consequences of trade reforms (see Krishna and Mitra, 1998; Diao, Somwaru and Roe, 2001; Beghin, Roland-Holst and der Mensbrugghe, 2002). However, in Africa, perhaps because of the lack of a complete individual national country accounts matrix, computable general equilibrium models are more often used to simulate joint policy effects for regions or economic blocs (Achterbosch et al., 2004). In this case, the country-specific characteristics and their potential effects are not relevant, or they are ignored. But the generalizations of the conclusions based on the simulated

data could eventually fail when the block-based evaluations suffer greatly from the effects of the entities. For example, sub-Saharan Africa has several countries, each with its own agricultural culture. Some have chestnuts economies and others have economies entirely based on cotton and therefore their interests must be in line with the characteristics of their economies, which suffer differently from the consequences of liberalization agreements. By focusing on one country, our study has the advantage of considering the strategic interests of the nation and the effects of trade tariff policies on different economic outcomes.

In addition, the argument that international tariff reduction agreements can promote the domestic development of poor countries and dependent essentially on the performance of the agricultural sector has been common, but no studies have been found for to analyze the sensitivity of the sectors in Guinea-Bissau, where agriculture is the main economic activity, to price shocks. The present study, through the application of a computable general equilibrium (CGE) model, can fill these theoretical and empirical gaps.

Understanding how the country's exports respond to tariff shocks can especially serve to guide the government in the elaboration of more consistent economic policies precisely in those sectors that have comparative advantages. Moreover, knowledge of the sensitivity of international trade will enable policymakers to deal with changes in income and employment levels, particularly in countries with a lower level of development and with the export agenda very concentrated in few agricultural products, such as Guinea-Bissau. Another contribution of the study is to verify if policies to promote export-oriented agricultural production have some trigger that can generate economic growth and/or poverty reduction.

This study seeks to answer the above questions with twofold fundamental objectives: (i) to analyze the proposal of tariff reduction formalized in the Doha agreement on the economy of Guinea-Bissau; and (ii) to contribute to the analysis of trade liberalization and its implications for development, particularly discussing the effects on poverty reduction and improved wellbeing. This analysis will be based on the Guinea-Bissau economy-based CGE model based on the 2007 social accounting matrix (SAM).

It is assumed that such agreements may have the potential to provide a stable trajectory of Guinea-Bissau's economic growth because, by encouraging agricultural exports, they may also represent an opportunity for greater external and domestic investment in sectors of the economy, and particularly, in the agricultural sector, contributing to the reduction of poverty. Apart from its potential to increase domestic employment and boost regional trade, DDA can benefit the population as it raises domestic wages because of improved wages throughout the region.

To contemplate such objectives this paper is structured as follows: the second section makes a brief historical incursion of the Doha round. The third one shows an overview of the external sector of Guinea-Bissau. The fourth section presents the SAM for Guinea-Bissau. The fifth section intended to present the general equilibrium model and the simulation strategies. The sixth section is focused on simulations results, and seventh concludes the discussion.

2. Doha round: an overview

Because a detailed review of the DDA has been already done by several authors (see Francois, Meijl and Tongeren, 2003) and institutions, including reports from international organizations, such as IMF and WB (see, for exemplo, IMF and WB,

2005), we sumarize the tariffs and subsides topics which are important to our study.

By the end of the 1980s, all trade negotiations were governed by the GATT (General Agreement on Tariffs and Trade), an organization created in 1947 to harmonize the customs policies of its signatories. However, for an organization that sought to improve the quality of international trade with only 22 members, it was very difficult to adopt measures to harmonize trade policies, even at the regional level. The African continent at the time was represented only by South Africa, which despite having a booming economy, its political and commercial influences on the continent were still very low. There was general resistance from other States to joining the GATT because it saw in it an organization that excluded their commercial interests, since it did not regulate trade in agricultural products.

The extraordinary economic growth of several developing countries and the consequent rapid trade expansion required the creation of a broader organization dealing with a variety of issues, not only those benefiting developed countries that produce industrialized goods. Thus, a round of negotiations for the liberalization of international trade was launched in 1986 in Punta Del Este, Uruguay, which would be important for regulating current trade relations.

The Uruguay Round resulted in the creation of the World Trade Organization (WTO) in 1995, with 148 members accounting for 97% of world trade, of which 2/3 were from the least developed and developing countries, indicating a broad participation of their States in new international trade agreements. However, it took another 16 years for agriculture to become an effective forum for discussion, which occurred only in the DDA in 2001 where the needs and interests of least developed and developing countries were first put at the heart of a negotiation (Elliot, 2007).

The DDA is the new round of negotiations from the first round in Geneva in 1947 to the Annecy rounds in 1949, Torquay in 1951, Geneva again, 1956, Dillion Round, 1960-61, Kennedy Round, 1964-67, Tokyo Round, 1973-1979, and Uruguay Round 1986-94. In it, several reform programs proposed in the immediately preceding round (as property anti-dumping measures, rules of origin, etc.) have been revised and extensively discussed, but fundamentally a reform program has correcting and preventing restrictions and distortions in world agricultural markets (WTO, 2001).

Such distortions stem from excessive agricultural subsidies by developed country governments, which have spent billions and billions of dollars each year to support their agricultural sectors. For example, support for agriculture in 3/4 of the Organization for Economic Co-operation and Development (OECD) countries was estimated at US$ 318 billion in 2002. More importantly, agriculture in these economies employs around 5 percent of GDP, while in less developed countries, such as Guinea-Bissau, agriculture accounts for around 70 percent of employment and more than 36 percent of GDP (FAO, 2003).

The FAO shows that subsidies affect agriculture in developing countries in different ways. The main direct effect is competition, since it allows the production of developed countries to be offered in international markets at prices below the value of production. This is harmful to poor countries, since because of the lack of advanced technology applied to production, the high costs make them unable to compete with their rich counterparts, causing farmers to lose a lot of money and invest less and less in the improvement of the production chain. Ultimately, populations in poor countries end up increasing demand for staple food imports.

Figure 1 shows the evolution of subsidies and other transfers carried out by the world, by low-income, middle-income, and by high-income countries in the period 2001-2015. Although middle-income countries increased their support after the DDA,

wealthy nations continued to support their domestic sectors even more, while subsidies and transfers from low-income nations were negligible or nearly zero throughout the period.

Figure 1 - Subsidies and transfers (in US$ million)
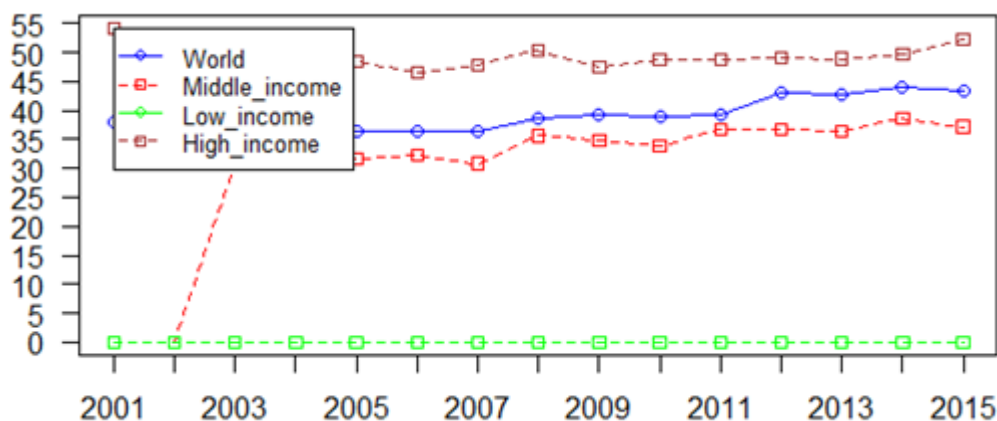
Source: Own elaboration. World Bank data.

To complete the commitments of members to promote substantial reductions in market access difficulties, it was recommended that export subsidies should also be reduced gradually to a date to be negotiated. For developed countries, it is recommended to eliminate domestic support that creates distortions to world trade, quantitatively corresponding to a cut of 20% of subsidies from the first day of the DDA (WTO, 2001).

The elimination or reduction of tariff peaks, high tariffs and tariff scale on products of interest to developing countries are expected to have a positive impact on the level of employment, output and poverty in those countries. The tariff data are shown in Table 1 for both the developed and developing economies and the world. Tariffs for primary commodities globally dropped by 68 percent, while declined by 33.4 percent for manufactured goods in the 10-year interval. Middle-income countries cut tariffs for primary products by 80 percent and tariffs for manufactured goods by 52 percent. In the same period, the low-income countries' tariff cuts for both products were 23 and 11 percent, respectively, while high-income countries cut tariffs for primary products by 61 percent and 11 for manufactured goods.

Tabela 1– Applied tariff rate, weighted mean (%)

Country	Products	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
World	Primary	6,47	5,26	4,68	4,59	3,14	3,08	3,2	2,53	2,68	2,08
	Manufactured	4,55	3,26	3,59	3,27	3,04	2,75	2,9	3,21	3,32	3,03
Middle inc.	Primary	12,65	8,14	7,83	7,67	5,94	3,82	3,91	3,33	3,39	2,53
	Manufactured	11,64	8,46	8,76	7,23	6,11	5,14	5,85	5,73	5,72	5,06
Low income	Primary	10,78	13,09	13,35	10,81	9,15	7,14	7,27	7,48	7,92	8,33
	Manufactured	10,89	14,24	12,94	11,75	13,06	12,02	8,69	10	9,79	9,65
High income	Primary	4,63	4,62	3,75	3,62	2	2,8	2,92	2,07	2,4	1,77
	Manufactured	2,19	1,98	1,89	1,87	1,68	1,78	1,76	1,78	2,06	1,91

Source: Own elaboration. World Bank data.

The tariffs for all products by type of economy are shown in Figure 2. With the same pattern as in Table 2 and Figure 1 above, rich nations adopt more export subsidy policies rather than cuts/reduction tariffs policies, which historically are lower than the reductions practiced in developing and less developed economies.

5

Figure 2 - Total applied rate, in weighted average (%)
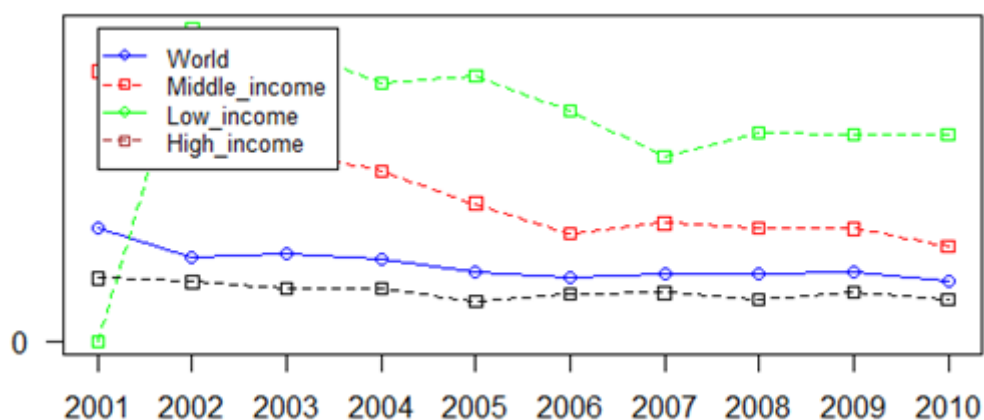
Source: Own elaboration. World Bank data.

Although there was no agreement on the band and the exact threshold of tariff reductions and the level of cuts in the distortion of support to the agricultural sector, in the General Council Decision 579, also known as July 2004 Package, the DDA found greater acceptance from WTO members. Anderson and Martin (2006, p.81) argue that the WTO DDA provides important new guidelines for negotiations on access to agricultural markets because it proposes tariff reduction through higher cuts in higher tariffs. For the Guinea-Bissau whose performance of the macroeconomic aggregates is heavily dependent on the performance of the agricultural sector, the agreement was signed with some enthusiasm.

The tariff rates applied by Guinea-Bissau individually to primary and manufactured products are close to those charged by least developed countries (Table 2). The important fact is that the country entered the DDA as a potential beneficiary of global tariff cuts but would have to give up subsidy policies on all items on its export agenda.

Tabela 2 – Guinea-Bissau Applied tariff rate (%)

Tariff rate	2001	2003	2005	2007	2009	2011	2013	2014
Manufactured products	15.03	13.59	13.56	13.48	12.97	12.78	13.43	12.99
Primary products	16.54	16.04	16.17	16.38	14.65	15.02	16.59	15.53
Averages	15.79	14.82	14.87	14.93	13.81	13.90	15.01	14.26

Source: Own elaboration. World Bank data.

As a country with an agriculture-based economy, the entry of Guinea-Bissau into the WTO may be of great importance for the sector's exports, because it will be treated in the same way as other countries. Table 3 shows the tariffs applied by the rest of the world to Guinea- Bissau products (Column 2) and tariffs applied to products from the rest of the world (Column 3). Tariffs were aggregated according to the SAM sectors. The growth rate of tariffs applied to imports was also calculated.

Table 2 - Tariffs on exports and imports (%) 2007

Sectors	SAM code	Exports by destination	Imports by origin	Percentage change over 2001
Millet	Sec1	6,10	4,80	-0,70
Sorghum	Sec2	6.13	5.00	-0,68
Maize	Sec3	6,10	4,80	-0,70
Rice	Sec4	6,10	4,80	-0,70
Fonio	Sec5	6,10	4,80	-0,70
Cotton	Sec6	9.83	5,00	-0,68
Other types of agriculture	Sec7	7.67	7.67	-0,51
Cashew nut	Sec8	17.5	20.00	0,27
Breeding and hunting	Sec9	6,10	4,80	-0,70
Forestry	Sec10	12,08	5.00	-0,68
Fishery products	Sec11	13.94	10.00	-0,37
Mining industries	Sec12	14.85	20.00	0.27
Food products and beverages	Sec13	18.56	11.88	-0.25
Other industries	Sec14	14.45	17.33	0.09
Electricity and water	Sec15	5,16	5,61	-0,64
Construction sector	Sec16	8.85	12.5	-0,21
Trading and repair	Sec17	5,16	5,61	-0,64
Hotels and restaurants	Sec18	5,16	5,61	-0,64
Transport and communications	Sec19	5,16	5,61	-0,64
Financial services	Sec20	5,16	5,61	-0,64
Real estate and services to firms	Sec21	5,16	5,61	-0,64
Non tradable tax	Sec22	5,16	5,61	-0,64
Averages		8,57	6,93	-0.56

Source: Own elaboration. World Trade Organization (WTO) data.

The tariff rate applied for all imported products in the 2001 (before the DDA policy went into operation) was 15.79 (Column 2, Table 2). Thus, in the last column in the last column of Table 3 the growth rate of tariffs applied to imported products shows decreases for all sectors, except for the cashew nut sector and mining industries.

3 Overview on external sector in Guinea-Bissau

Guinea-Bissau represents the typical example of a small economy. It has one of the globally lowest final private consumption spending- just over US$ 960 million - and a GDP per capita of US$240; its production is highly concentrated in agriculture, about 60%.

Trade activities have become an alternative to generating national income. The free trade practices potentiated with the multilateral agency recommendations packages in the mid-1980s would find a government with a keynote address to insert the economy internationally.

From the commercial point of view, the entry of Asian countries into the African continent, thanks to its extraordinary economic growth, represented an opportunity for the country to meet potential partners. In fact, from this period India and Singapore became the main trade partners of Guinea, with shares of bilateral trade exceeding 86% and 12%, respectively, while Portugal is only 0.52%, Netherlands 0,25% and Panama

0,21% (Figure 3).

Figure 3 - Guinea-Bissau top 5 Export and Import partners in US$ million and in %, 2018
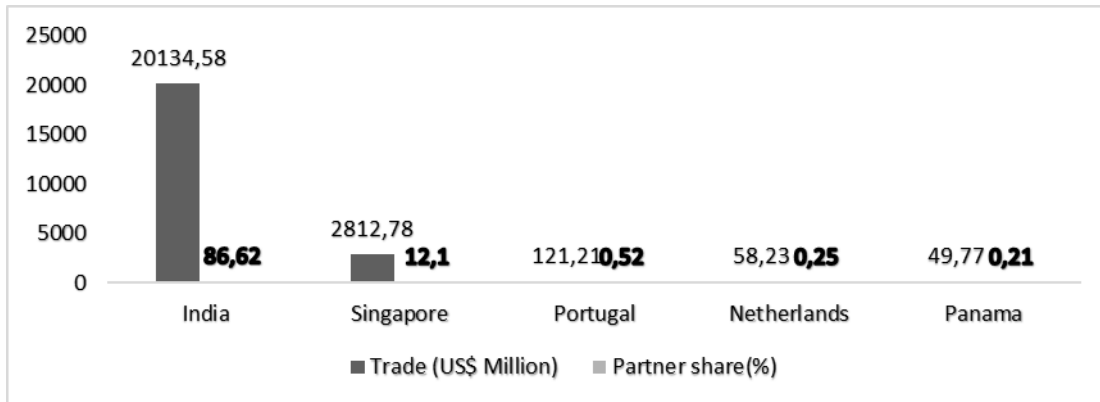
The meteoric growth of 1155.00 percent of exports in the period from 1990 to 2016 results from a policy aimed at encouraging exports, mostly raw materials. Figure 4 shows the distribution of exports and imports by product group. It shows that more than 99% of Guinean exports are represented by low value-added raw materials. It is also possible to observe that the country exports little intermediate goods, consumer goods and capital goods, and the participation of the later group of products in the exporting grid is very low.
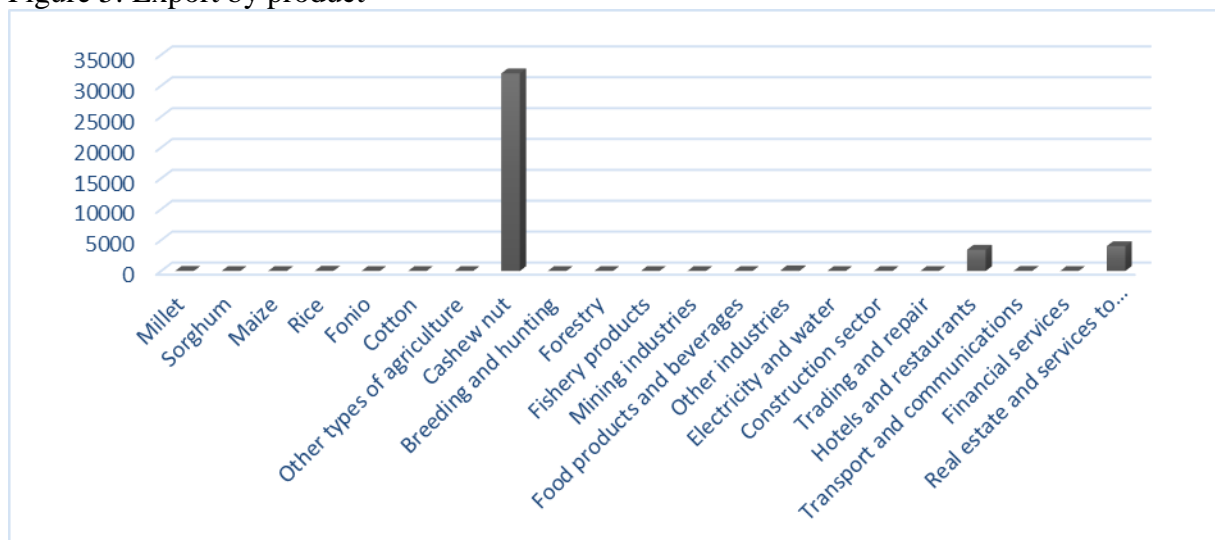
Figura 4 - Guinean exports by value added (in US$ million) and product group participation in the exporting grade (%), 2018
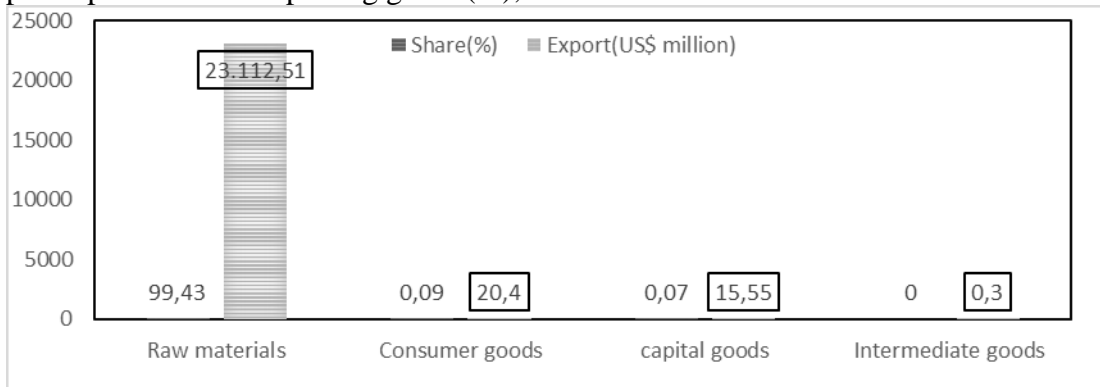
The information extracted from Guinea-Bissau's social accounting matrix for 2007 clearly shows the predominance of cashew nuts among exported agricultural commodities (Figure 5).

Figure 5: Export by product

Imports come from different sources, mostly from countries outside the African continent. Considering US$ 110 million spent on the purchase of foreign goods, in 2017, US$ 47 million corresponds to aggregate expenses with products from the European Union, US$ 30 million with Senegal products, US$ 8 million with products from Thailand, US$ 5 million with Ivory Coast products and US$ 5 million were earmarked for the purchase of Brazilian production. The shares of the main suppliers in total imports from Guinea-Bissau show a clear predominance of the European Union (42,28%), Senegal (27,29%) and Thailand (7,71%), followed by Côte d'Ivoire (4,18%), Brazil (2,68), the Gambia (2,08%), India (1,99%), other unspecified countries (1,3%) and Singapore (1,29%) (WTO data, 2017).

4 Social Accounting Matrix

There are several separate institutions or actors in a market economy. The SAM is a photograph of the monetary flows accounts of these agents in an economy (national or regional) that one wishes to distinguish. It is possible to have an integrated system of accounts that relate multiple accounts in a consistent and closed manner. Consistency can be understood both in the micro sense and in the macro sense. The SAM of an economy is micro consistent when the income expenditure flows of each agent satisfy its budget constraint and is said macro consistent if the aggregate flows of all agents satisfy the standard aggregates. According to Cardenete, Guerra and Sancho (2012, p.78), this double consistency is of vital importance for modeling an economic policy, since it allows the researcher to combine the available monetary data with an operational model of general equilibrium whose analytical structure is based on these data.

Technically, it is different from an input-output (IP) matrix; the main characteristic of a SAM is that each row and column reflect a separate account to which expenses and receipts must balance, hence their quadratic nature. The focus is on nominal flows, with lines representing receipts (or revenues) and columns representing

expenditure accounts (DERVIS, DE MELO and ROBINSON, 1982; LOFGREN ET AL., 2002)

4.1 SAM for Guinea-Bissau 2007

With the support of the International Food Policy Research Institute (IFPRI), the SAM of Guinea-Bissau was built by Cabral (2015) from the African Growth and Development Policy Modeling Consortium (AGRODEP) and provides comprehensive information on the country's economy in the year 2007.This subsection, therefore, aims to present a circular flow picture of Guinea-Bissau's economy in 2007 in a single unified set of accounts.

The SAM of Guinea-Bissau has 22 sectors, 9 production factors and 85 accounts, classified into six main groups, which are: factor accounts, institutions accounts, activity accounts, household product accounts or commodity accounts, export accounts and accumulation accounts. The macroeconomic structure of SAM that we will use to build our CGE model can be seen in Table 3.

Each account represents the agent relationships determining the dynamics of the economy in the period in question. The factors of production are offered in the market and their effective use for production represents costs in terms of wages and rent; they are remunerated conventionally, that is, paid based on their marginal costs; the revenues are transferred to households in the form of factor income. The family income, already in the accounts of the institutions, comes from two sources: wages and transfers from the government.

After the receipts, the income is used by the families in several ways: one part is destined for the payment of taxes, another for the consumption of domestically offered goods and another for savings. In addition to normal operations, companies receive subsidies and pay taxes to the government, which they also receive from family and the rest of the world. Through redistributive policies, the government transfers can go as income to households, subsidizes companies, accumulates international reserves that can be used for a variety of purposes, mainly for offsets between residents and non-residents or the rest of the world. The government consumes and saves part of its revenues. International capital entering the country can be used to buy domestic production (exports) or to finance domestic consumption. The accumulation accounts and their interconnections with the other matrix vectors complete the interconnection of the flows.

Tabela 3 – Structure of a macro social accounting matrix for Guinea-Bissau, 2007

		Factors (1)			Institutions (2)				Activities (3)	Commodities (4)	Exports (5)	Accumulations (6)	
Expenses													
		Labor	Capital	Land	Household	Entreprises	Govovern-ment	Rest of the World				Investment-saving	Inventories
Receipts													
Factors	Labor Capital Land								Wages Rentals Rentals				
Institu-tions	Household	Labor income	Capital income	Land income			Transferns	Capital inflow					
	Entreprises						Operating subsidies						
	Govern-ment				Tax on income and weath	Tax on production		Custom duties	Value added tax	Tariffs			
	Rest of the World						Reserve ac-cumulation			Imports			
Activi-Ties										Domestic commodity supplies			Inventories
Commo-dities					Private consumption		Government consump-tion		Interme-diate inputs			Investment	
Exports							Export subsidy	Exports					
Accumu-lations	Investment-saving Inventories				Private saving		Government saving						
Totals		Factor income	Factor income	Factor income	Household income		Government expenditure	Foreign exchange inflow	Total costs	Total Absorption	Exports	Investment	Inventories

Fonte: Own elaboration.

Understanding how SAM is built can help us to better understand the core structure of the CGE model to be simulated, in addition to its extensions in future essay.

5. Computable general equilibrium model for Guinea-Bissau

The potential economic effects of tariff policy are analyzed using a conventionally specified CGE model (Shoven and Whalley, 1973, 1984, 1992; Taylor and Black, 1974; Whalley, 1975; Harris, 1984; de Melo 1988; Despotakis and Fisher, 1988; Pereira and Shoven. 1988; Conrad and Schroder. 1993; Nestor and Pasurka Jr, 1995; Waters et al., 1997; Böhringer and Löschel, 2006; Taylor and Arnim, 2007; Liu et al. 2017). It clearly shows how policy initiatives in an integrated global economy through trade provoke substantial adjustments of the different patterns of production and consumption in a small open economy.

National policies are highly subject to external events such as changes in the terms of trade or international prices through changes in the flows of exports and imports from countries that can change the direction and size of policy effects. The model is short-term because it does not admit the intersectoral mobility of factors, and it is Walrasian because determines only relative prices.

As in Cattaneo, Hinojosa-Ojeda and Robinson (1999), factor prices, product prices and the exchange rate are defined in relation to a producer price index, from which a price is defined as the numeraire. The model is structured in the tradition of trade-focused CGE models described by EcoMod course, a no linearized framework, since uses GAMS programming language to set up simulation requirements and to solve the model with the standard solvers.

5.1 Theoretical structure of the model

A CGE model is a compact structure through which the markets for goods, productive factors and currencies are sensitive to changes in the conditions of demand and supply, which in turn are affected by policies that generate changes in relative prices. Figure 6 illustrates the theoretical structure of the model, which represents the production of the domestic good, domestic supply, and domestic demand; defines several levels of optimization during the productive process of firms and household consumption. In the productive structure of the firms, the basic inputs (X_{1x1}, ..., X_{1X22}, X_{22x1}, ..., X_{22X22}) chosen over fixed proportions of Leontief are transformed into intermediate inputs of the sectors. The transformations of the primary factors (K_1, L_1, N_1; K_{22}, L_{22}, N_{22}) into additional values are modeled according to the constant substitution elasticity (CES) function.

Figure 6 – Standard General equilibrium model for open economy
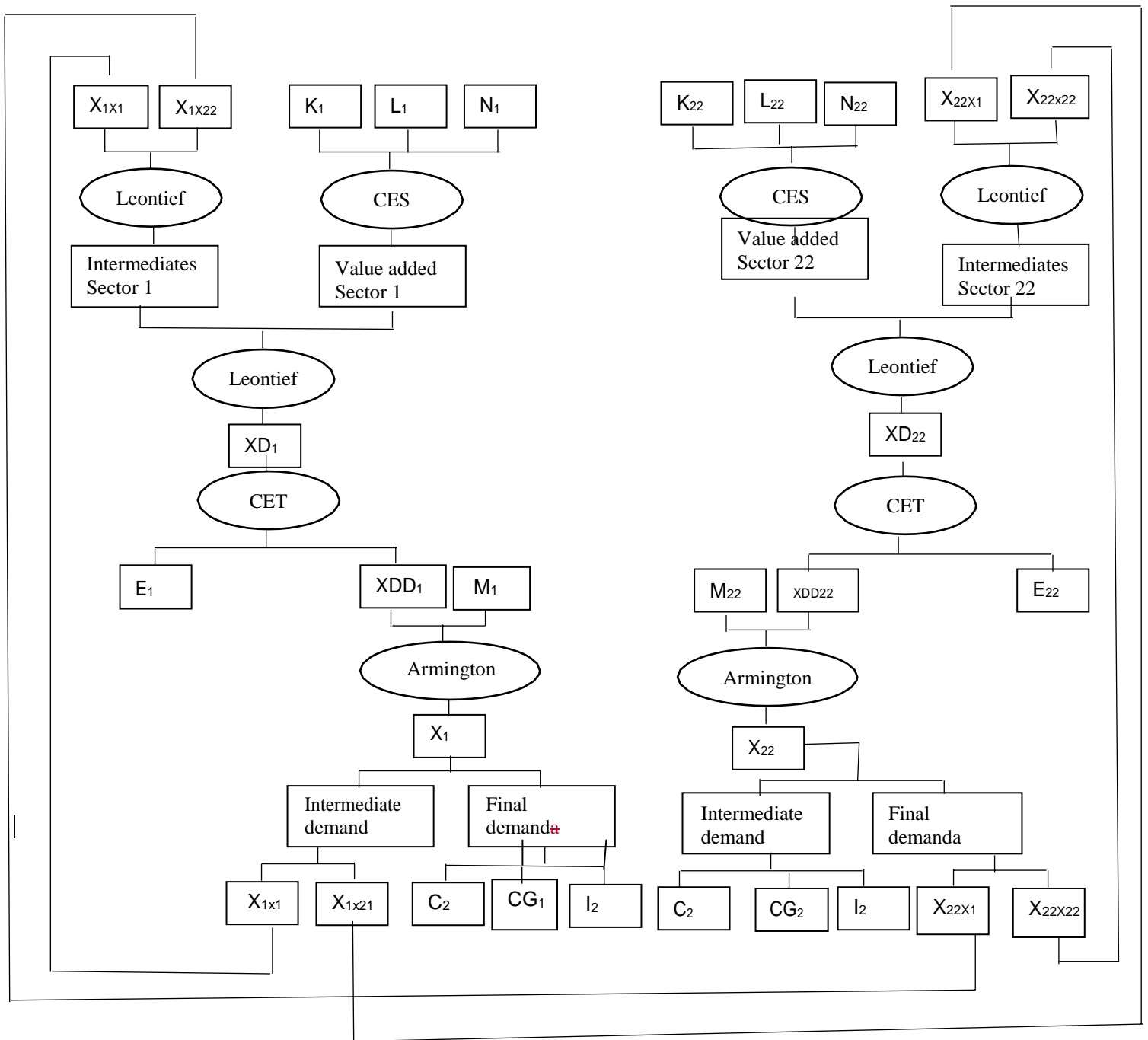
Fonte: Own elaboration. Adapted from EcoMod.

A Leontief specification is adopted from the hypothesis of a fixed proportion combination in the use of intermediate inputs and added values to produce the domestic commodity. The domestically produced commodity (XD_1, ..., XD_{22}) is now sold either in the domestic market (XDD_1, ..., XDD_{22}) or abroad (E_1, ..., E_{22}). A function of the constant transformation elasticity (CET) is used to model this transformation of domestic production. On the other hand, domestic demand now originates from domestic (XDD_1, ..., XDD_{22}) and foreign sources (M_1, ..., M_{22}).

To define the composite commodity (X_1, ... X_{22}) it was necessary to adopt Armington's (1960) hypothesis that a firm produces a composite commodity using the domestic commodity offered to the domestic market and imports of that commodity. Therefore, the composite commodity is either used as an input into the productive process of the twenty-two domestically produced commodities or is sold for final use: private consumption (C_1, ..., C_{22}), government consumption (CG_1,...,CG_{22}) and investments (I_1, ..., I_{22}).

There is a representative family consuming local commodity and composite commodity. The demand equations of families are derived from the problem of maximizing their utility. This maximization follows hierarchical steps, where at the lower level the choice between domestic commodity and composite one is carried out in a combined system of CES preferences. The generated utility of domestic and composite commodities consumption is maximized by this function, already at the highest level.

The demand for exported commodity is defined in usual way, that is, demand curves are negatively skewed in world market prices. A vector of elasticities is therefore defined to capture the response of external demand to changes in relative prices. Since the economy to be modeled is of a small country, then it has no influence on the world price of exports and imports.
The government, under a balanced budget, has savings allocated on firms' investment demand according to the Cobb-Douglas utility function.

5.2 Data and model calibration

This paper contributes not only to understanding the potential economic effects of international agreements in a small country, but it can also provide very important results for the purposes of socio-economic policies. The EGC model for Guinea-Bissau, to our knowledge, is the first highly disaggregated CGE model for this economy. Our model is built based on 2007 SAM for Guinea-Bissau; it contains 22 sectors and 22 commodities. The primary factors were aggregated into three categories (capital, labor and land). There are four components of final demand formed by household consumption, government consumption, investment-stocks and exports.

Perhaps the most critical issue surrounding the application of CGE modeling is to find the initial parameters of the model. In poor countries, the lack of data and thus systematic empirical studies make it difficult to obtain the parameters that indicate, for example, the degree of substitution for the relevant products of interest. When they exist, it is reasonable to assume that they are not stable. For example, in sub-Saharan Africa, there are numerous countries that were under colonial rule and later became independent; many countries have moved from a dictatorial regime to a partisan more diffuse one. It is not difficult also to find examples of those from socialism to a competitive market economy. All these aspects can lead to important changes in the structural parameters in a CGE model.

Two approaches have been used to determine the parameters: calibration techniques (Dawkins et al., 2001), the Entropy approach and the Bayesian Entropy method (Cattaneo, Hinojosa-Ojeda and Robinson, 1999, Mitková, 2016). The Optimal Fingerprint Detection Methods are also a used form for parameterization of a CGE model (Koesler, 2015). In the absence of data that produce the historical behavior through which the elasticities are derived, it is common or resorting to studies conducted for economics with similar characteristics that the economic modeler wishes

to approach (Thurlow and Van Seventer, 2002), or to define them in an ad-hoc way (Mohammed, 2016) or to estimate them using standard econometric techniques (Hubler and Pothen, 2014).

As in Mohammed (2016, p.398), most of the parameters for our model are defined endogenously in a way that ensures that the base solution for the model reproduces exactly the values in the SAM. From this, the simulation design is as follows: it is assumed that taxes are proportional to their tax bases and that the replacement rate should be, at most, equal to 50% of the wage rate.

The domestically produced commodity is allocated in the domestic market and exported according to a CET function. The internal productive structure strongly concentrated in the agricultural production, allows to think that the CET is different for both commodities consumed internally and exported.

The domestically produced commodity sent to the domestic market and imports are combined into a single composite commodity by adopting the Armington hypothesis of product differentiation by place of origin, which gives rise to the CES function. Again, based on the characteristic of the Guinean economy, it is reasonable to assume that industrialized commodities cannot be perfectly replaced by agricultural commodities. In other words, since the country does not produce industrialized goods, rising prices of the rest of the world for these goods may not alter national demand for imports. The elasticities of substitution between commodities of the predominantly agricultural sectors and commodities of sectors with predominance of industrialized commodities are assumed to be different. But between one sector with strong agricultural content and another one with the same characteristic (or between one industrial sector and another) the elasticities were defined uniformly.

5.3 Simulation strategy

For simulation it is necessary to adopt two procedures. In the first place, economic theory is used to define some hypotheses of economic variables, to compare their results with those obtained through policy simulation. This anticipation of results is of extreme importance, because the effects of the policy represent deviations from the pre-established causal relationship. The second procedure is to calibrate the tariff shocks in the reference scenario. The results of the base solution that replicates SAM values will serve as comparisons with those of policy simulation.

5.3.1 Simulation closure

A closure can be defined as follows: (i) the number of endogenous variables must be consistent with the number of equations; and (ii) the set of declared equations is not structurally or numerically singular.

The present model can be used for simulations of short-term comparative static and for projection of policy results. The closure is related to the treatment given to the functioning of the economy and capital stock adjustment (Domingues and Haddad, 2005). Assuming the time lag of policies, in the short term, capital stocks are held fixed, while in the long run capital stocks may be affected by policy changes. Capital, labor and land allocations are set exogenously.

The reference scenario is simulated with the short-term closure, incorporating some assumptions regarding consumption and other expenses. It is assumed that household consumption follows national nominal income and that government spending follows household income. Thus, an increase in national income increases household

consumption, while raising household incomes by raising government revenue through, for example, more tax payments, increases their ability to finance and raises the government expenses.

The amount spent on consumption also depends on the real wage, which affects the structure of firms' costs and the level of employment in the economy. There is a negative relationship between the rate of change in real wages and the rate of change in the unemployment rate. The Phillips parameter is -0.1 and unemployment of 30% is taken as the basis in the historically average observed of the last 30 years. The consumer price index has the Laspeyres specification.

In addition, import prices are exogenously given, a result of the assumption of the small open economy; the balance of payments is in equilibrium. Policy simulation consists of reducing tariffs by 56%, keeping the real exchange rate fixed at its initial level, allowing capital movements (external savings) as an instrument to restore the balance of payments, for possible external imbalances.

After the implementation of the shock and calibration, it was necessary to test the model to verify the possible database balancing errors. As the CGE model in the GAMS language should be homogeneous of degree zero for changes in the numeraire (sectorial price indices or exchange rate), a homogeneity test was applied in the short-term closure. The immediate implication of a homogeneous model is the indirect confirmation of the preposition that only relative prices matter. The expected result is that if all the nominal variables in the exogenous list collide in 1%, and if the model is homogeneous, then any percentage change in the nominal variables should also be 1%, but the real variables (quantities) should not be changed. The test consists in applying a 1% shock on the wage rate (the numeraire). The result obtained agrees with the prediction, that is, the nominal variables of the model changed by 1%, but the real variables did not change. In addition, the Walras' law was also checked for.

5.4 Systemic effects of tariff reductions

The model incorporates a detailed specification from the rest of the world, which allows the identification of aggregate and sectoral effects because of tariff changes. A decline in tariffs is expected to increase imports. For a given level of exports, there is a drop in the terms of trade. Perhaps not instantaneously, but the level of sectorial activity must accompany the decline in terms of trade. In this case, the demand for available labor is low and many workers wish to work but they cannot find employment because the current structure of firms' productive costs does not allow them to make new hires. Aggregate employment should decrease. There are lands that could be used for production, but the entrepreneurs are not signing rental contracts for their use. Even with the rate of return in domestic currency being now lower than before policy, they will also not undertake new ventures that require much capital input.

Therefore, the main central transmission channel of a tariff liberalization policy on a small economy occurs via a downward shift in the demand curve of the primary factors (land, capital and labor). In the case of jobs, any contracts between workers and firms should be made based on smaller wage payments, providing a lower level of income for the families of Guinea-Bissau; consumption decreases with falling real wages. In general, GDP should decrease with the fall in tariff rates.

6. Results

This section aims to present and discuss the simulation results of a negative

shock in the tariff rates on imports applied by Guinea-Bissau on the structure of its economy. The impact of a policy can have different effects for the sectors and for the main macroeconomic aggregates. Thus, after the presentation of the simulated macro results, the results at the sector level are subsequently reported.

The macroeconomic results of a 56% negative shock on import tariff rates are reported in Table 4, showing that the decline in tariffs leads to an increase in the consumer price index (Column 3). The remuneration of capital has decreased, but the policies of tariff reduction cause an increase in the land´s return. The government's demand did not change because its revenues declined; the total transfers accompany, even more, the fall in the public revenue collection.

Compared to the base results, there was a worsening simulated scenario, except for land rent, whose result in the simulation scenario was higher than the one in the baseline. The decrease in tariff rates leads to an increase in the involuntary unemployment rate by 32%, a result that is higher than the initial 13% of the base.

Tabela 4 - Short-term aggregate results after import tariffs reduction

PREÇOS	Simulation[*]	Baseline[**]
Consumer price index	1.028	1.00
PRIMARY FACTORS		
Return to capital	-38.45	0.615
Wage rate	0.00	0.00
Land´s return	610.93	7.11
Others		
Real government demand	0	0
Tax revenues	-2.70	17718.34
Total transfers	-9.40	623,40
Unemployment	31.67	13.17

Source: Own elaboration. Simulation results. * Results after the shock of -0.56% in tariff rates. ** Results before the simulation.

The results at sector level are presented in Table 5. Household consumption decreased in 15 sectors, with increases occurring only in the Food products and beverages, Electricity and Water, Construction, Trading and Repair, Transport and Communications, Financial Services sectors and Real estate and business services. The main drop in consumption occurred in the Non-tradable tax, which decreased by -24.63%.

Investments demand increased in five sectors (Construction, Negotiation and Repair, Transportation and Communications, Financial Services and Real Estate and Business Services). The Negotiation and Repair sector was the one with the highest increases in investment demand, 13.57%. In response to the decline in tariff rates, investments declined in the remaining 17 sectors of the economy.

A negative shock of 56% on import tariffs leads to an increase of 53.60% in exports of the Fishery products sector, 66.41% in exports of the food and beverages sector, 68.8% in the other industries, 27.63% Electricity and water, 96.83% Negotiation and Repair sector, 48.50% in the Transport and Communications sector, 76.51% in the Financial Services sector and more than 100% in the real estate and business services sector. Exports in 13 sectors reacted negatively to a passive tariff policy, with emphasis on the Mining and Hotel and Restaurant sectors, whose exports decreased by 100 percent. Imports, on the other hand, increased in most sectors due to the fall in import tariff rates. As a result, terms of trade declined in 13 sectors and increased in nine others.

Import tariff reduction policies increase the output of some sectors, but the

production of many others has declined in response to this policy.

In a scenario of comparison with baseline results (before the shock - Columns 8-13), it is possible to observe that consumption and exports decreased in the simulation scenario, while imports rose. There was a loss of terms of trade and investments. All the effects described together contribute to the fall in GDP of the Guinean economy.

Tabela 5 – Sector short-term results after import tariffs reduction

Sectors	Simulation*						Baseline**					
	Consump-tion	Investi-ments	Exports	Imports	Terms of trade	GDP	Consump-tion	Investi-ments	Exports	Imports	Terms of trade	GDP
Millet	-20.34	-100.00	-44.20	13.00	-57.20	0.84	10670.60	-2.84	6.82	21.85	-15.03	10716.60
Sorghum	-20.74	-100.00	-45.05	16.80	-61.88	0.97	6439.34	-1.81	3.85	12.84	-8,99	6468.07
Maize	-21.60	-100.00.	-48.11	17.29	-67,40	1.49	9580.70	-2.90	5.71	20.00	-14.29	9639.05
Rice	-19.06	-100.00	-46.60	14.64	-61.24	0.86	392993.7	-9.63	23.00	78.00	-55.00	39824.97
Fonio	-24.46	-100.00	-55.70	5.14	-60.84	-9.06	634.54	-0.14	0.44	1.05	-0.61	637.50
Cotton	-12.06	-13.19	-34.53	-6.77	-27.76	-12.10	4130.50	191.00	2.62	6.53	-3,93	6192.60
Other types of agriculture	-14.66	-100.00	-29.20	11.38	-40.58	0.97	9232.35	-1.70	5.70	13.37	-7,67	9548.65
Cashew nut	-7.63	-100	-95.05	-88.76	-6.29	-94.83	0.00	-2.11	1583.0	0.00	1583.00	1749.55
Breeding and hunting	-4.17	-100.00	-7.02	-4.08	-2.94	-5.18	13293.80	-0.55	0.00	306.00	-306.00	14692.64
Forestry	-7.02	-7.03	-22.28	13.96	-36.24	-5.72	7416.82	975.30	1,60	0.00	1,60	8821.31
Fishery products	-0.37	-100	53.60	67.94	-14.34	44.68	56753.18	-17.91	0.00	0.00	0.00	58188.05
Mining industries	-73.45	-71.71	-100.00	-50.68	-49.32	-81.45	0.80	30.83	0.00	75.60	-75.60	63.27
Food products and beverages	4.72	-100.00	66.41	27.64	38.77	26.44	98037.65	-20.10	8.32	39694.00	-30685	78137.55
Other industries	-2.00	-100.00	68.80	15.65	53.15	20.87	25543.76	-9.70	209.30	86077.00	-85867,9	11006.00
Electricity and water	4.44	-100.00	17.63	-7.18	24.81	-17.27	608.86	-0.01	0.00	0.00	0.00	2385.10
Construction sector	8.33	9.80	-71.51	-93.87	22.36	-92.32	0.00	924.44	0.00	0.00	0.00	924.50
Trading and repair	12.10	13.57	96.83	25.10	71.73	14.47	0.00	90613.4	0.00	0.00	0.00	101821.6
Hotels and restaurants	-5.26	-3.60	-100.00	-9.00	91.00	-99.89	782.56	0.00	0.00	0.00	0.00	6.32
Transport and communications	9.04	10.51	48.50	2.44	46.06	-7.09	7822.50	0.00	47.52	0.00	47.52	30132.00
Financial services	12.00	13.45	76.51	9.45	67.06	0.52	714.50	0,00	0.00	0.00	0.00	2498.00
Real estate and services to firms	4.13	5.61	148.36	0.94	147.66	83.79	6709.03	0.00	9984.2	19266.07	-9281.89	14322.61
Non tradable tax	-24.63	-23.00	-73.30	-44.31	-29.00	-53.70	0.00	0.00	0.00	0.00	0.00	63446.11

Source: Own elaboration. Simulation results. * Results after the shock of -0.56% in import tariff rates. ** Results before the simulation.

Table 6 shows that negative tariff shocks cause a drop-in household income and consumption. As a result, its utility has diminished, suggesting that a liberalization policy can generate a loss of wellbeing for Guinean citizens. However, this result was expected, since we are doing a short-term analysis.

Table 6 – Welfare analysis after import tariffs reduction

Variable	Simulation	Baseline
Household income	-2.70	319478.45
Expenditure on consumption	-2.70	306393.50
Utility	-6.043	31992.47

Source: Own elaboration. Simulation results.

Through the percentage changes obtained by the policy simulation, the monetary values can be calculated. An exercise of this type was made, and Table 7 reproduces the behavior of sectoral variables. Negative tariff shocks do not change the amount of commodities consumed in the Cashew nut, Construction, Negotiation and Repair and Non-tradable tax sectors, but negatively affects consumption in the Millet, Sorghum, Maize, Fonio, Cotton, Other activities Agricultural, Hunting, Forestry, Fishing Products, Mining Industries, Other Industries and Hotels and restaurants sectors. The biggest drop occurred in the rice sector, US $ -7,490.460 million.

Consumer demand for commodities in the food and beverages, electricity and water, transportation and communications, financial services and real estate and business services sectors increased, with the food and beverages sector showing the highest consumption increase, over US $ 462,737.7 million.

The investments do not change in all services sectors and in the Transport and communications and Hotels and restaurants; the highest decrease was in the forestry sector, US $ -6,856.4 million and the highest increase in the Negotiation and repair, US $ 1,229,624 million.

The exported quantities did not change in two service sectors: Financial Services and Non-tradable tax, but also in the Creation and Hunting sectors, Fishing Products, Mining, Electricity and Water, Construction, Trading and Repair and Hotels and Restaurants. The cashew nut sector was the one that suffered most from the reducing tariffs on imports policy, a drop of US $ -150.464 million in exports.

In response to this policy, imports of Food and Beverages and Other Industries increased by US $ 1,097,142 and US $ 1,347,105 million, respectively, while in the mining industries there was a drop of US $ -3,831.4 million in demand for imports, implying greater external balance for this sector, a total of US $ 3728.6 million. Meanwhile, the Food and Beverages sector was the one that had the most increase in its GDP (US $ 2,065,957) and the greatest fall was in the Non-tradable tax sector.

Tabela 7 – Base results updated after simulation of import tariffs reduction

Sectors	Consumption	Investiments	Exports	Imports	Terms of trade	Real GDP
Millet	-217040	284	-301,44	284,05	859,71	9001,94
Sorghum	-133552	181	-173,44	215,712	556,3012	6274,02
Maize	-206943	260	-274,70	345,8	963,146	14362,18
Rice	-7490460	963	-1071,8	1141,92	3368,2	34249,5
Fonio	-15520,8	14	-24,508	5,397	37,1124	-5775,75
Cotton	-49813,8	-2519,3	-90,468	-44,2081	109,0968	-74930,5
Other types of agriculture	-135346	170	-166,44	152,150	311,2486	9262,19
Cashew nut	0	211	-150464	0	-9957,07	-165910
Breeding and hunting	-55435,1	55	0	-1248,48	899,64	-76107,9
Forestry	-52066,1	-6856,4	-35,648	0	-57,984	-50457,9
Fishery products	-20998,7	1791	0	0	0	2599842
Mining industries	-58,76	-2210,8	0	-3831,41	3728,592	-5153,34
Food products and beverages	462737,7	2010	552,5312	1097142	-1189657	2065957
Other industries	-51087,5	970	14399,8	1347105	-4563879	229695,2
Electricity and water	2703,338	1	0	0	0	-41190,7
Construction sector	0	9059,5	0	0	0	-85349,8
Trading and repair	0	1229624	0	0	0	1473359
Hotels and restaurants	-4116,27	0	0	0	0	-631,305
Transport and communications	70715,4	0	2304,72	0	2188,771	-213636
Financial services	8574	0	0	0	0	1298,96
Real estate and services to firms	27708,29	0	1481256	18110,11	-1370564	1200091
Non tradable tax	0	0	0	0	0	-3407056

Source: Own elaboration.

These results generally indicate large negative short-term impacts in terms of well-being and poverty. These results can be analyzed in the light of the Guinea-Bissau economic features. Since its independence, agricultural sector has been seen as having potential comparative advantages, with development efforts aimed at promoting its modernization with the aim of increasing production and exports so as to take advantage of trade gains and prevent or eliminate imbalances in the external accounts (HAVIK, 1990).

The industrial sector became the subject of discussion only in the mid-1980s, when the volume of domestic peanut production was already very high and required the creation of an internal market for its processing, considering the need to promote the aggregation of value added to the exporting commodities. Even before the only complete agroindustry, the "*Complexo de Cumeré*", to enter in full operation, several unfavorable events occurred in the country, with emphasis on the drought in 1983/84 that hit heavily rural regions, the debt crisis of developing countries and the sharp fall in the international price of peanuts, the main export product. As public-sector revenue was increasingly dependent on export taxes, the drop in peanut prices further worsened the public budget.

Efforts to diversify agricultural crops, however, have resulted in the emergence of production in mass of a new economically profitable commodity, cashew nut. This commodity, which the great part of the population until then did not know its economic value and used it only for own consumption, became the main national product in 1985. However, there were enormous difficulties in exporting it, due to several reasons, among which demand from Portugal, then Guinea's main trading partner, for nuts was generally very low and the country was facing competition from Ivory Coast, Philippines, Nigeria, India and Vietnam in the new world market. Were it not for the sudden and unprecedented surge in Indian demand, one could hardly imagine that cashew nuts would be established in the next decade as a source of government revenue and income for households nationwide.

The Government was aware of the importance of the foreign exchange generated by the increase in exports and of the taxes previously mentioned, the structural adjustment program in 1986, having been part of a set of measures created in Breton Woods and designed to assist countries with problems in their balance of payments, the management of state accounts and the promotion of self-sustaining economic growth, occurred at a time when domestic production had already been oriented to foreign markets, due to the high price of cashew nuts in international markets.

The early 1990s were of importance to Guinea-Bissau: the end of the Cold War made it possible to move more rapidly towards the establishment of multilateral organizations, and the first multiparty presidential election in 1994, made it possible for greater participation of the population in discussions of development plans.

Such elections were treated by the authorities as fundamentally necessary for the country's integration into international organizations, which culminated in its entry into the WTO in May 1995.

Its entry into the WTO and a consequent 56% reduction in import tariffs has proved to be an ineffective policy to improve exports of its main production sector. Welfare at the national level falls, not only because the Government depends on cashew nuts export taxes, but because this sector is a source of income for the households. So, as their exports have fallen, as well as their production, household income and consumption should decrease, justifying the fall of the utility and welfare.

The effects on the production that the model was able to capture bring an expansion of the millet, sorghum, maize and rice sectors, but also in other agricultural activities, food products and beverages, other industries, trading and repair, and in the service sectors. This shows that, although it is not able to reduce poverty, the tariff reduction policy could promote the diversification of national production.

Confronting these findings with those of empirical literature analyzing trade liberalization, it can be said that the results of the CGE model for Guinea-Bissau's economy showed interesting results. Initially, Devarajan (1989) already calibrated CGE model for the Cameroon data, finding that manufacturing sectors on the whole contract, and the cash crops sector is the main beneficiary. They argued the beneficial consequence of expanded imports is offset by labor being pulled away from the modern, high-wage sectors. Annabi *et al.* (2005) use a dynamic GGE model for Senegal and concluded that trade liberalization induces small increases in poverty and inequality in the short term as well as contractions in the initially protected agricultural and industrial sectors. However, Durongkaveroj (2014) applies the same methodology to simulate free trade policy effects on the Thailand economy and showed that removing tariffs increases the national prosperity. The conventional literature argues that while the increased demand generated by liberalization does not directly affect the poor, it can do so indirectly by increasing the demand for goods produced by them.

7. Conclusions

The main goal of this study was to analyze the initially formalized tariff reduction policy in the Doha agreement on the Guinea-Bissau economy, seeking to understand the potential quantitative effects of trade policies and their implications for development in a small economy heavily based on production and agricultural exports.

A negative shock in tariff rates contributes to increase national unemployment and reduce the capital's return. Land's return responds positively to the decline in tariffs.

Sectors respond differently to tariff shocks. Consumption, investment and exports increased in a small number of sectors and declined in most sectors of the economy of the calibrated social accounting matrix, which contributed to the fall in the terms of trade and GDP. Trade liberalization agreements based on reduced tariffs worsen in the short run the welfare of households as their utility diminishes.

This is a matter of relevant international insertion policy because, as Guinea-Bissau maintains its position as a predominantly agricultural economy, the pursuit of trade agreements may not be beneficial to all sectors, including those essentially producing agricultural commodities. Further studies can be required, but what we have in the present is that the main export sectors, such as the cashew nut sector, hotels and restaurants, and Real estate and services to firms' sectors, decreased their production by more than 80% after import tariffs reduction simulated in this study.

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