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What are the expected effects of trade policies on Poverty in Senegal? a CGE Micro-Macro Analysis*

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Abstract

There is an ongoing debate on the role of trade policies in alleviating poverty. Indeed trade liberalization is supposed to improve economic growth (Dollar and Kraay, 2002; Irwin and Tervio, 2002; Frankel and Romer, 1999). Focusing on poverty alleviation and income inequities, the positive impact of trade is less consensual. Some works have defended the idea that trade integration implies poverty reduction (Bhagwati and Srinivasan, 2002; Dollar and Kraay, 2004; Anderson and Martin, 2005), but most recent surveys have not reached this general conclusion, pointing that the link between trade and poverty can be puzzling (Winters, McCulloh and McKay, 2004; Goldberg and Pavcnik, 2007; Harrison, 2007). According to these surveys, trade policies bring contrasted effects on poverty but region or sector-specific conclusions can be done. In that sense, Goldberg and Pavcnik (2004) have wrote:

> "While establishing a clear link between trade liberalization and absolute poverty poses a tremendous challenge, especially in rural areas, documenting the correlation between trade liberalization and certain indicators of urban poverty in the short- or medium-run seems more promising."

This paper aims at assessing the expected effects of trade policies on poverty reduction in Senegal. Especially, the main issue is to point out the distributional effects of trade policies among households, following regional, sectoral, occupational and skills features. Then, our article consists in building a single-CGE model, adapted to poor countries and doing counter-factual micro-simulation analysis to underline the income and distributional effects of tariff-reducing under different scenarios. Thus, in order to match with the Senegalese economy, our CGE-model framework arises from two main issues: treating households heterogeneity and modeling the labor market in order to reflect at the closest a dual-dual economy,[1], that means to distinguish urban from rural sectors and formal from informal activities.

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[1]This expression borrowed from Stifel and Thorbecke (2003) refers to the double dichotomy between urban and rural areas and formal and informal sectors

To treat the first issue, we disaggregate households as most as possible, following all available criteria in the all set of Senegalese households surveys[2], namely by region and milieu of living, marital status and number of children, occupation and degree of qualification. This gives us 265 representative households that allow us to work in a combined micro-macro simulation framework. By this way, it is possible to develop a model in which different kinds of workers can be modeled and thus address our second issue (namely modeling a dual-dual economy). Indeed, many of the classical CGE studies in international trade work with simple sets of assumptions about the labor market that are not appropriated to developing countries, assuming especially fixed or uniform labor supply. Thus, to address this, our CGE model presents a mechanism which endogenizes labor supply and a labor-market segmentation which distinguish the unskilled from the skilled workers. This allows us to capture the skill-specific labor market effects of shifts in international trade patterns. Besides, the distinction between workers attached to the rural versus the urban sector is important, since regional mobility must be taken into account. Finally, we take into account mobility between formal and informal sectors because productivity and wages differentials imply different effects of trade policies. As in most CGE models, formal and informal labor are used in separate sectors.[3] We decide to adopt a modeling that is inspired from Stifel and Thorbecke (2003), but design it in order to match with our sectoral decomposition (34 sectors in the economy, allocated into formal/informal and urban/rural ones, instead of 4 representative sectors in Stifel and Thorbecke, 2003). As underlined by Boeters and Savard (2011), this kind of modeling brings new issues such as the need to obtain labor supply estimates that can be used in our combined micro-macro model.[4]

After the model is designed and calibrated on a SAM built for the year 2006 (Fall, 2011), different scenarios of trade policies are applied. The first scenario is an EPA agreement between Senegal and Europe. Indeed, the EU and its ACP partners were unable to conclude the EPA negotiations as planned on January 1st 2008 and this is still an ongoing process. The second scenario is full liberalization. These trade policies have already been assessed in the literature, but mainly using multi-countries CGE models (Berisha-Krasniqi et al., 2008; Fall et al., 2007) or using a dynamic recursive computable general equilibrium (Cissokho and Diop, 2011). Our micro-macro framework is complementary and necessary to evaluate the impact in terms of poverty alleviation.

1 Trade liberalization and Poverty in Senegal, a literature review

1.1 Stylized Facts

1.2 The CGE Micro-Macro framework

2 The model: a CGE-micro simulation approach

Our target is to design a single computable general equilibrium that is the most relevant as possible to model an African economy such as Senegal can be. In this perspective, we

[2] ESAM I, 1995; ESAM II, 2002 and ESPS, 2005

[3] Actually, only models with strong sectoral aggregation present formal and informal activities in the same production function (See for an example the MIMIC model of Graafland et al. 2001).

[4] This last point can be treated by following the methodology suggested by Cogneau and Robilliard (2008) and Bourguignon and Savard (2008).

base the framework of our model on the previous works of Rodrick (1997) and Stifel and Thorbecke (2003) who built a CGE framework for an archetype African economy, called "Dual-Dual CGE model".

On this basis, we design and adapt our model to implement baseline scenarios of trade liberalization. After what, we introduce different micro-foundations of transfers in order to assess the impact of domestic transfers on the income distribution after an external shock on prices and check the robustness of our results.

2.1 A dual-dual Economy

The dual-economy models of Lewis (1954) and Fei and Ranis (1964) are pertinent frameworks to build a model adapted to Senegal. The central concept of these models is the modeling of sectoral dualism, inherent in developing countries. But actually, as underlined by Stifel and Thorbecke (2003), two main features can help to conceive the idea of dualism: first, the existence of strong inequalities between rural and urban regions, in terms of localization of the activities and in second place the dichotomy between traditional technologies, in which most of firms are family-owned and modern technologies hold by more complex organizations. This double dichotomy between sectors, thus underlined, leads to classify sectors into four categories: in one hand, rural sectors that can be divided into formal (exporting agriculture, with capital-intensive technology) and informal sectors (subsistence agriculture), and urban sectors, formal (mainly manufacturing) or informal (services) in the other. In reference to this double-dichotomy, Thorbecke called this kind of models "dual-dual economy". Contrary to the dual-economy models, these new developments introduce a geographical component of analysis, where both urban and rural areas know situations in which informal sectors emerge to absorb the residual labor force, unemployed in the formal sector. This geographical dimension allows improving our understanding of poverty, migrations and the motivations to remit and above all, it provides a rich model in which distributional effects of trade policies can be better explained.

Is this description is relevant in case of Senegal?

Senegal, as many other African countries, presents significant informal jobs, both in the agriculture and in the urban sectors. Subsistence agriculture and especially fishing is an archetype example of what is an informal sector, labor-intensive production, employing in the majority, unskilled workers. In urban areas, services are widely informal sectors, unlike manufactures which are capital-intensive production processes.

[descriptive figure]

Thus, on the basis of the dual-dual economic model from Stifel and Thorbecke (2003), we build a single computable general equilibrium in which the economic dichotomy is determinant to the construction of the labor market. The next sub-section presents the production framework and the labor market.

2.1.1 Production and the labor market

In our model, domestic production of sector i (xd_i) is decomposed into value-added (va_i) and intermediate consumptions (ci_i), following a Leontief function. The value-added is produced using a composite factor of mobile inputs (capital K, skilled L_S and unskilled

labor L_U) and specific inputs (land) that are expressed following a CES function. Finally, at a third stage, another CES function reflects the combination of mobiles factors. This specification of the production allows specifying different degrees of substituability at each stage. We need to precise that the public agent does not produce public good following the same scheme, since production is a Leontief function of intermediate consumption, labor and capital. Appendix A provides schematic representations of the different production processes. Now, in the following, we describe the labor market which is very specific to developing countries, reflecting the duality of their economy.

There are two kinds of labor: skilled and unskilled workers. If the unskilled workers are perfectly mobile between formal and informal sectors both in urban and rural areas, the skilled workers are only employed in the formal sectors. This means that production function of informal sectors does not contain units of skilled workers and only combine unskilled jobs and capital. Considering some stylized facts, we pick up important features that need to be modeled. First, concerning the unskilled workers (annotated by index "U" ("S" for the skilled ones), wages in the informal sectors are lower than wages in the formal one, such as

$$w_U^i < w_U^f, \tag{1}$$

where exponent "i" denotes informal sectors whereas "f" denotes formal ones. Further explanations can be advanced: presence of a minimum wage in formal sectors that implies a rise of all wages, or presence of transaction costs which can be considered as a social cost to move from informal to formal sectors, which is compensated by a financial retribution. Besides, productivity per worker is higher in the formal sector, benefiting from capital-intensive process of production. Furthermore, as Harris and Todaro (1967) have underlined, there is a wage premia in the urban formal sector compared to the rural sector. So, finally, wages in formal sectors are always higher than in informal sectors, and urban wages usually exceed rural wages. Following that statement, we should observe that most workers are employed in rural sectors in the case of Senegal.

Because unskilled and skilled workers are not substitutable, our model contains two distinct labor markets, following the level of education. Here it is important to notice that the supply of skills is exogenous in the economy

$$\overline{L} = \overline{L}_U + \overline{L}_S. \tag{2}$$

Next, we describe the equations defining both supplies and demands of different kinds of labor in each sector, and equilibrium wages.

Wages of unskilled workers in informal sectors (both in urban and rural areas) are defined as the weighted average of the labor product, returns perceived by each hired unskilled worker, expressed as follows

$$w_u^{i,r} = \frac{pp^{i,r} xd^{i,r} \beta_{L_U}}{L_u^{i,r}}, \tag{3}$$

where β_{L_U} is the supply elasticity with respect to unskilled labor. So at equilibrium, unskilled rural labor allocate itself with respect to the following condition

$$w_u^{f,r} = w_u^{i,r}(1+\delta), \tag{4}$$

where δ is the transaction cost implied by migration from informal sector to the formal one, in rural area. Taking a job in rural export sector induces psychological and financial costs

that are representing as a financial compensation, which justifies that $w_u^{f,r} > w_u^{i,r}$. In urban sector, workers are also paid for their marginal revenue product. In addition, if they are employed in formal urban sector, they receive a share of the firm's profits, justifying also that $w_u^{f,u} > w_u^{i,u}$, in reference to the observed wage premium. The urban formal sector adopts efficiency wages to prompt intensive effort, so the equilibrium condition in the urban area, between formal and informal activities is written as following:

$$\begin{aligned} w_u^{f,u} &= w_u^{i,u} + \gamma \frac{\Pi}{L_u^{f,u}} \\ & \quad where \\ w_u^{i,u} &= \frac{pp^{i,u} xd^{i,u} \beta_{L_U}}{L_u^{i,u}}. \end{aligned}$$

Now that we have described the equilibrium conditions which allocate the unskilled labor force between formal and informal in each localization, we need a condition that defines migration of these unskilled workers between urban and rural activities, so to define $L_{\cdot u}^{u}$ and $L_{\cdot u}^{r}$. In the same spirit of Harris and Todaro (1967) and Stifel and Thorbecke (2003), we model the urban-rural wage gap such that unskilled workers move towards urban areas until the rural wage is equal to the expected wage in the urban sector. We precise that each worker who cannot obtain a job in the urban formal sector is likely to work in the informal one until he reaches his objective to be hired in the formal importing sector in the next period. This equilibrium condition is expressed by

$$w_U^{f,r} = \left(1 - \frac{hL_U^{f,u}}{L_U^{f,u} + L_U^{i,u}}\right) w_u^{u,i} + \left(\frac{hL_U^{f,u}}{L_U^{f,u} + L_U^{i,u}}\right) w_U^{f,u}, \tag{5}$$

where $\frac{hL_U^{f,u}}{L_U^{f,u}+L_U^{i,u}}$ is the probability of being hired in the formal, urban sector, which is in fact, the share of the urban uneducated labor force in that sector multiplied by a scale parameter. This equilibrium condition defines the proportion of unskilled workers who moves to urban areas $L_{\cdot U}^{u}$, so implicitly we can write

$$L_{\cdot U}^{r} = \overline{L}_U - L_{\cdot U}^{u}, \tag{6}$$

that defines the supply of unskilled labor in the rural areas.

Now turning to the skilled labor force, which is only employed in formal sectors, we need to explain the wage differential between urban and rural skilled jobs, $w_S^u > w_S^r$. As many studies have underlined, this inequality is often explained by the presence of union labor forces in the urban sectors only. The specification used is the one proposed by Booth (1995), namely the monopoly union labor which is powerful and thus fixes the urban wage for skilled workers, by maximizing its utility function:

$$\begin{aligned} &\underset{w_S}{Max} U(w_S, L_S) \\ &\quad L = L_S(w_S). \end{aligned}$$

The labor union gives the same importance to the present skilled labor force, hired in the urban sector, than to the potential labor force currently hired in the rural sector. Thus there is an alternative wage, namely, in rural area. Knowing this, the utility function to maximize is expressed by the following equation

$$U\left(w_S^u\right) = \left[L_S^u\left(w_S^u\right)\right] u\left(w_S^u\right) + \left[L_S - L_S^u\left(w_S^u\right)\right] u\left(w_S^r\right),$$

where $u(w_S) = \frac{w_S^{1-\theta}}{1-\theta}$, and θ is a preferential parameter, reflecting a present preference. This specification, reported in Stifel and Thorbecke (2003), comes from the three main hypothesis of skilled job market: the perfect inelastic substituability between skilled and unskilled, the full employment of skilled workers and the distinctive feature of these skilled workers, only hired in formal sectors. Finally, the equilibrium condition of urban-rural skilled labor force resulting from this maximizing problem, is

$$w_s^{u,f} = \left[\frac{1 - \beta_{Lu}^{u,f}}{(1-\theta)\,\beta_{Ls}^{u,f} + \theta\left(1 - \beta_{Ls}^{u,f}\right)} \right] w_s^{r,f}, \tag{7}$$

that defines the variable L_S^u, thus we only need one more equation to define L_S^r, assuming the absence of unemployment

$$L_S^r = \overline{L}_S - L_S^u. \tag{8}$$

Finally, at the equilibrium, all wages are ascertained by the equalizing of labor supplies and labor demands, on each labor market. Demands of labors follow from profit maximizing in each sector of the economy.

2.1.2 Trade, consumption, and the government

Total exports are splitted into two destinations (developing countries vs. developed ones), following a CET function. A second level of repartition is modeled to distinguish European partners from the other developed countries and to isolate the ECOWAS members from the other developing partners. This adoption of a double CET allows us to evaluate the impact of an EPA between european and ECOWAS countries. Symmetrically, imports are modeled following the same scheme, in two-steps, but using CES functions.

Regarding consumption, each consumer maximizes its utility function, a combination of a private consumption and a public good (Cobb-Douglas function)

$$U(C_{pri}, C_{pub}) = C_{pri}^{\alpha} C_{pub}^{\beta}.$$

The private consumption is then divided into an agricultural composite product and a non agricultural composite, linked by a CES function

$$C_{pri} = ac \left[C_{ag}^{-\sigma_c} + \sum_{i \in inag} \left(dt_i^{-\sigma_c} \right) \right]^{-\frac{1}{\sigma_c}},$$

where C_{pri}, C_{ag}, and dt_i denote respectively total private consumption, agricultural composite good and non-agricultural goods consumption. This specification allows us to specify different degrees of substitutability between goods, for example between two agricultural products, that are more substitutable.

The government is designed as a producer of the public good, by using labor, capital and intermediate consumption combined with a Leontief function. The government has for objective to maintain its public revenue. Thus if tariff income decreases with trade liberalization, then public revenue is compensated by three alternative channels: a lump-sum tax supported by all households, a consumption tax or finally a tax defined proportionally to household gross income.

2.2 Data: a macro-micro simulation approach

Our study is based on three household surveys ESAM I, ESAM II and ESPS, for respectively the years 1994-1995, 2001-2002 and 2005-2006. Furthermore, our model is calibrated on a social accounting matrix (Fall, 2011), which includes 33 private sectors and one public sector. So, we have at our disposal, in one hand, macroeconomic and sectoral information about production, exportation and importation, public and private consumption, taxes or other inter-agents transfers. In the other hand, we have microeconomic information from the different surveys which give us detailed features about Senegalese households, in terms of income (detailed sources), education levels, occupation, consumption levels by products among other criteria. Thus we disaggregate the traditional representative household into various categories, with respect to individual heterogeneity. This allows us to assess income distribution effects in our simulations results. We present in this section available data, the manipulations we've done and finally we present some descriptive statistics on the main economic stylized facts of Senegal.

The main challenge is to reconcile households surveys in two ways: first in merging ESAM I and ESPS databases, since some variables are only reported in ESAM I (household incomes, transfers and taxes) and secondly in matching these micro-defined variables with national reported data in the SAM, dated from 2006. A difficulty comes from the methodological differences between the surveys: sample sizes, questions, variables of interest. Our strategy consists in aggregating households by common criteria present in both surveys, namely region, milieu, gender, education levels and marital status. Once the data aggregated, some categories of households are represented in only one of the surveys, this is especially true for ESPS, which concerns a greater sample size. In these cases, we apply the average value of an affiliation group. Groups are shaped by the k-1 criteria, where k is the total number of aggregation keys. To take an example, if a woman who lives in Ziguinchor, in rural area, is single and is not educated, is not represented in ESAM I, then we apply the average values of uneducated women who live in Ziguinchor, in rural area, whatever their marital status.

3 Trade policies simulations

3.1 Main results

Two scenarios of trade liberalization are implemented. Firstly, an Economic Partnership Agreement (EPA) among european countries and ECOWAS members. Secondly, a full liberalization scenario between Senegal and all its partners. Table 1 presents the global effects of these two scenarios on exports, production, government income and household welfare.

Table 1: Global indicators of trade liberalization

variations in %	EPA	Full
Vol of exports	-0,814%	0,185%
Vol of production	-0,681%	-0,394%
Government income	1,177%	0,662%
Welfare	0,0003%	-0,014%

It appears that full liberalization is likely to bring better results in terms of export performance, since the volume exported increases by 0.185% while its decreases when a EPA is simulated. Regarding production volumes, both scenarios imply cuts in volume, but full liberalization seems less degrading than the EPA. Conversely, the EPA scenario brings better results in terms of government income and household welfare (whatever the increase is very slim 0.003%). Now, it is important to decompose these effects, by sectors and destination. Morover, an analysis of poverty and inequality effects can bring complementary results and will be discussed in the next sub-section.

Table 2 reports the sectoral variations of production and exports, expressed in volume. The results reported correspond to the two scenarios of trade liberalization implemented.

Table 2: Sectoral variations (%)			Volume of Prod (%)		Exports (%)	
	Code	Share	EPA	FULL	EPA	FULL
Food crops	A1	0,037	-1,04092	-0,68184	-0,08775	0,887074
Industrial Agriculture	A2	0,015	-1,00609	-0,56173	1,196854	1,86445
Farming and hunting	A3	0,028	-0,24298	-0,1706		
Forestry	A4	0,007	-0,69262	-0,47345		
Fishing	A5	0,017	1,798538	1,417688	2,401641	2,818767
Extractive activities	A6	0,012	-0,57767	-0,24021	1,340572	2,096708
Prepared foodstuffs	A7	0,03	-0,33566	-0,1372	-0,07265	0,612878
Animal or vegetable fats, oils	A8	0,014	-2,6633	-1,47021	-0,78696	0,202036
Milling industry products	A9	0,022	-1,81781	-1,06934	-0,99833	0,016836
Cereal products	A10	0,021	0,056176	0,008674		
Sugar confectionery	A11	0,006	-4,65417	-2,77143	-3,00355	-1,24493
Edible preparations	A12	0,017	-3,20208	-1,82705	-1,79472	-0,43094
Beverages	A13	0,006	-1,56062	-0,97697		
Manufactured tobacco	A14	0,004	-0,74178	-0,42933	-0,06381	0,617985
Cotton fabrics and textile	A15	0,017	-1,40887	-0,88095	-0,95425	0,018402
Leather	A16	0,002	-6,39628	-4,05079	-4,75991	-2,50294
Wood and wooden articles	A17	0,007	0,734533	0,380181	1,302154	1,397163
Paper products and paper pulp	A18	0,011	-0,57998	-0,33133	0,285269	0,853233
Mineral fuels	A19	0,016	-4,36624	-2,44975		
Chemical products	A20	0,028	-1,35516	-0,72395	0,782684	1,390084
Rubber articles	A21	0,008	-1,53854	-0,86893	0,529294	1,212247
Pottery, glass products	A22	0,019	1,023647	0,634415	-3,67392	-1,34687
Base metal products	A23	0,011	0,074419	0,080526	-4,09853	-1,57908
Machinery	A24	0,003	1,44224	0,871739	2,043947	2,211944
Equipments and electric products	A25	0,003	2,10638	1,296787	0,608083	1,321506
Transportation	A26	0,001	2,35483	1,280072		
Diverse products	A27	0,012	-1,27719	-0,7343	-10,0103	-5,57236
Power, gas and water	A28	0,03	-0,33857	-0,2081		
Construction	A29	0,105	2,58948	1,487446		
Public Administration	A30	0,051				
Education and formation	A31	0,025	0,397306	0,20755	0,066487	0,074771
Health and social activities	A32	0,011	0,247378	0,122591	-0,50784	-0,2606
Collective activities	A33	0,017	0,19339	0,101363	-0,00871	0,013337
Market services	A34	0,39	0,27307	0,156373	-0,09656	-0,02748
Total		1	-0,68197	-0,3943	-0,81443	0,185769

The sectors that benefit from trade liberalization are Fishing, Machinery and equipment sectors, for which both production and exports volumes increase with trade (EPA and full liberalization). Production of all services sectors raises in both cases. In many cases, a full liberalization improves export performances more than an EPA agreeement. This is the case of prepared foostuffs, animal and vegetable oils, milling industry, manufactured tobacco or cotton industry. The sectors that loose a lot are leather and sugar industry.

The next two tables reports the sectoral variations of exports, by destination. Four groups of partners are defined: the European and the ECOWAS countries that contract

an EPA and two other groups that gathers together rich partners ans other developing countries.

Table 3: Variation of exports for an EPA, by sector and destination (%)

Code	Sector	ecowas	eu	oth. Devd	oth. Devg	Total
A1	Food crops	3,48	-0,81	-1,28	-1,75	-0,09
A2	Industrial Agriculture	4,48	0,79	0,24	-0,73	1,20
A5	Fishing	5,43	2,28	1,66	0,24	2,40
A6	Extractive activities	4,60	0,97	0,41	-0,61	1,34
A7	Prepared foodstuffs	2,21	-0,42	-0,78	-1,31	-0,07
A8	Animal or vegetable fats, oils	1,63	-1,27	-1,60	-1,91	-0,79
A9	Milling industry products	1,44	-1,50	-1,82	-2,11	-1,00
A11	Sugar confectionery	-0,22	-3,86	-4,09	-3,84	-3,00
A12	Edible preparations	0,78	-2,43	-2,72	-2,80	-1,79
A14	Manufactured tobacco	2,28	-0,42	-0,70	-1,42	-0,06
A15	Cotton fabrics and textile	1,52	-1,44	-1,70	-2,20	-0,95
A16	Leather	-1,89	-5,69	-5,82	-5,64	-4,76
A17	Wood and wooden articles	3,51	1,09	0,76	-0,16	1,30
A18	Paper products and paper pulp	2,58	-0,01	-0,31	-1,12	0,29
A20	Chemical products	4,08	0,31	0,00	-1,26	0,78
A21	Rubber articles	3,85	0,02	-0,27	-1,48	0,53
A22	Pottery, glass products	0,07	-4,71	-4,88	-5,17	-3,67
A23	Base metal products	-0,31	-5,19	-5,34	-5,55	-4,10
A24	Machinery	5,29	1,66	1,32	-0,10	2,04
A25	Equipments and electric products	3,95	0,10	-0,20	-1,41	0,61
A27	Diverse products	-6,86	-11,51	-11,48	-10,19	-10,01
A31	Education and formation	0,03	0,26	-0,05	0,03	0,07
A32	Health and social activities	-0,44	-0,41	-0,69	-0,50	-0,51
A33	Collective activities	-0,03	0,17	-0,14	-0,03	-0,01
A34	Market services	-0,10	0,06	-0,23	-0,12	-0,10
Total		1,65	-1,28	-1,59	-2,05	-0,81

When an EPA is simulated, even if the global effect seems negative, some industries take some benefits: industrial agriculture, fishing and extractive activities, but also wood and paper industries, chemical products and machinery. But, some sectors know important export deterioration, namely diverse manufactured industries, pottery and base metals productions, leather industry and sugar and edible preparations activities. Obviously, ECOWAS partners are the main contributors of the benefits reported.

Table 4: Variation of exports for a full liberalization, by sector and destination (%)

Code	Sector	ecowas	eu	oth. Devd	oth. Devg	Total
A1	Food crops	1,56	-0,92	1,14	1,77	0,89
A2	Industrial Agriculture	2,26	0,19	2,37	2,63	1,86
A5	Fishing	2,98	1,24	3,54	3,51	2,82
A6	Extractive activities	2,44	0,45	2,66	2,84	2,10
A7	Prepared foodstuffs	1,10	-0,29	0,42	1,22	0,61
A8	Animal or vegetable fats, oils	0,77	-0,75	-0,04	0,83	0,20
A9	Milling industry products	0,62	-0,95	-0,25	0,65	0,02
A11	Sugar confectionery	-0,40	-2,36	-1,69	-0,54	-1,24
A12	Edible preparations	0,26	-1,45	-0,76	0,23	-0,43
A14	Manufactured tobacco	1,18	-0,21	0,24	1,26	0,62
A15	Cotton fabrics and textile	0,67	-0,85	-0,41	0,67	0,02
A16	Leather	-1,48	-3,58	-3,16	-1,79	-2,50
A17	Wood and wooden articles	1,83	0,65	1,10	2,01	1,40
A18	Paper products and paper pulp	1,37	0,05	0,51	1,48	0,85
A20	Chemical products	2,18	0,31	0,76	2,31	1,39
A21	Rubber articles	2,02	0,12	0,57	2,14	1,21
A22	Pottery, glass products	-0,19	-2,60	-2,18	-0,41	-1,35
A23	Base metal products	-0,40	-2,85	-2,43	-0,64	-1,58
A24	Machinery	2,89	1,18	1,65	3,13	2,21
A25	Equipments and electric products	2,12	0,23	0,69	2,25	1,32
A27	Diverse products	-4,21	-6,80	-6,41	-4,87	-5,57
A31	Education and formation	0,05	0,19	0,02	0,05	0,07
A32	Health and social activities	-0,23	-0,20	-0,36	-0,26	-0,26
A33	Collective activities	0,00	0,11	-0,06	0,00	0,01
A34	Market services	-0,03	0,07	-0,10	-0,04	-0,03
Total		0,77	-0,76	-0,09	0,82	0,19

When a full liberalization is implemented in the model, export performances are globally improved. Developing countries seems to be the main actors of those benefits. If the lost are supported by the same sectors as n the EPA case, some industries now take some benefits from trade: this is especially true for industrial industry and food crops.

Now, Table 5 reports the price effects of trade liberalization.

Table 5: Price effects of trade (%)

Code	Sectors	P_cons		P_va		P_exp		P_imp	
		EPA	FULL	EPA	FULL	EPA	FULL	EPA	FULL
Food crops	A1			0,01	0,01	0,45	0,43	-1,09	-0,71
Industrial Agriculture	A2	-0,80	-0,48	-1,02	-0,59	0,29	0,29	-0,59	-0,34
Farming and hunting	A3	0,46	0,30	0,47	0,31			-0,09	-0,06
Forestry	A4	0,44	0,27	0,34	0,22			-0,68	-0,45
Fishing	A5	-0,81	-0,57	0,22	0,24	0,12	0,19	-0,14	-0,09
Extractive activities	A6	-0,67	-0,44	-0,24	-0,16	0,22	0,24	-0,43	-0,25
Prepared foodstuffs	A7	0,13	0,03	-0,36	-0,23	0,35	0,27	-1,36	-0,83
Animal or vegetable fats, oils	A8	-1,12	-0,70	-0,25	-0,17	0,46	0,34	-4,07	-2,45
Milling industry products	A9	0,03	0,00	-0,29	-0,18	0,47	0,35	-2,50	-1,47
Cereal products	A10	0,46	0,26	-0,19	-0,13			-0,91	-0,54
Sugar confectionery	A11	-0,15	-0,12	-0,13	-0,10	0,69	0,48	-4,33	-2,64
Edible preparations	A12	-0,24	-0,16	-0,22	-0,15	0,54	0,38	-4,06	-2,36
Beverages	A13	0,12	0,04	-0,09	-0,08			-4,85	-3,02
Manufactured tobacco	A14	0,08	0,01	-0,18	-0,12	0,44	0,34	-3,61	-2,35
Cotton fabrics and textile	A15	0,36	0,19	-0,31	-0,19	0,54	0,40	-1,69	-1,12
Leather	A16	0,33	0,17	-0,37	-0,23	0,91	0,60	-2,96	-1,93
Wood and wooden articles	A17	0,04	0,01	-0,37	-0,23	0,33	0,29	-0,88	-0,56
Paper products and paper pulp	A18	0,01	-0,03	-0,23	-0,15	0,44	0,32	-2,24	-1,38
Mineral fuels	A19	-0,04	-0,04	-0,22	-0,15			-7,06	-4,31
Chemical products	A20	-0,65	-0,43	-0,24	-0,16	0,49	0,36	-3,46	-2,10
Rubber articles	A21	-0,50	-0,34	-0,31	-0,20	0,50	0,37	-3,98	-2,43
Pottery, glass products	A22	3,38	1,87	7,91	4,46	0,95	0,60	-9,95	-5,99
Base metal products	A23	3,15	1,71	7,77	4,38	0,97	0,61	-4,87	-2,98
Machinery	A24	0,06	-0,05	6,53	3,68	0,34	0,31	-2,33	-1,54
Equipments and electric products	A25	1,29	0,67	1,15	0,62	0,59	0,43	-3,90	-2,49
Transportation	A26	0,85	0,43	5,40	3,04			-3,28	-2,17
Diverse products	A27	5,67	3,20	8,63	4,86	1,54	0,90	-0,55	-0,43
Power, gas and water	A28	3,56	2,01	7,47	4,21			0,05	0,03
Construction	A29	3,28	1,84	6,89	3,89			0,02	0,01
Education and formation	A31	0,16	0,06	0,00	-0,03	0,06	0,03	0,08	0,04
Health and social activities	A32	0,39	0,20	-0,08	-0,07	0,14	0,07	0,16	0,08
Collective activities	A33	0,14	0,06	-0,35	-0,22	0,07	0,04	0,07	0,03
Market services	A34	0,22	0,11	-0,27	-0,17	0,09	0,05	-0,03	-0,01

Table 6 reports the variations in price factors, by category of sectors. It seems the relative abundant factor, namely unskilled labor knows increases of their remuneration, whatever the trade scenario. This increase is even greater than unskilled are employed in urban areas and this is even more important when an EPA is simulated. Conversely, skilled workers know decreases in their remuneration (less important for a full liberalization). Price of Capital presents contrasted results: if it decreases in formal sectors (even more in rural area), it increases in informal sectors (even more in urban areas).

Table 6: Price factors variations (%)

Factor	Sector	EPA	FULL
Capital	Formal rural	-2,64	-1,51
	Formal urban	-0,43	-0,26
	Informal rural	0,15	0,22
	Informal urban	9,19	5,18
Skilled Labor	Formal rural	-0,50	-0,31
	Formal urban	-0,50	-0,31
Unskilled Labor	Formal rural	0,90	0,48
	Formal urban	1,15	0,62
	Informal rural	0,90	0,48
	Informal urban	1,15	0,62

These elements speak in favor of an impact of trade liberalization on income inequalities, which suggests to focus on a poverty analysis through different indicators that are presented in the next sub-section.

3.2 Results on Poverty alleviation

Now focusing on the poverty effects of trade liberalization, we assess the household inequalities, to see if trade opening affects those inequalities. It appears from Table 5 that full liberalization presents more beneficial or at least less degradable effects on income inequalities. Five indexes are computed, but bring opposite conclusions. Indeed, Gini and Atkinson indexes, as the coefficient of variation index conclude to an increase of income inequalities among our household categories. This is especially true when EPA is concerned. Some contrasting results appear when Quantile and share ration indexed are computed. Their variations following an EPA and full liberalization are negative, reflecting a decrease in income inequities.

Table 5: Inequalities effects, measured with households' net income

	Base	EPA	FULL
Gini index	0,647	0,063%	0,034%
Atkinson Index	0,356	0,119%	0,065%
Coefficient of variation index	2,331	0,232%	0,134%
Quantile Ratio index	0,040	-0,237%	-0,379%
Share ratio index	0,078	-0,291%	-0,503%

Now, as the aim of this paper is to assess the impact of trade in poverty alleviation, it is important to compute some absolute poverty indexes. That is why we present three different measures of poverty and compute their variation follwing the different trade shock. The next table shows that trade seems to reduce poverty.

Table: Poverty reducing effects of liberalization

	Base	EPA	FULL
Foster, Greer and Thorbecke index	0,943	-0,019%	-0,010%
Watts index	3,677	-0,091%	-0,048%
Sen, Shorrocks and Thon index	0,978	-0,006%	-0,003%

Poverty line fixed at 1000 CFA/a day

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