Poverty Impact Assessment of the AfCFTA's Implementation: A Macro-Micro Simulation Approach

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Abstract:

The main objective of this study is to assess the potential impact of the implementation of the AfCFTA on poverty and inequality in Africa. Using a combination of the MIRAGE model and a microsimulation model, it conducts several simulations to trace the trajectory of poverty and income inequality indices in key economies of the continent.

Key words: AfCFTA, Poverty, CGE, Microsimulation, Africa

Introduction

The African Continental Free Trade Area (AfCFTA) was officially launched on January 1, 2021. This date constitutes the culmination of several years of work and intensive negotiations on the content and architecture of the Agreement establishing the AfCFTA and the modalities for its implementation. The execution of the AfCFTA Agreement aims, among others, at establishing a single continental market for goods and services and to expand intra-African trade through better harmonization and coordination of trade liberalization and facilitation. The AfCFTA should help African countries to boost economic growth to achieve the targets of the SDGs and those of the 2063 African Union's Agenda, including the objectives of reducing poverty and inequality explicitly mentioned in these agendas.

Because of the persistence of poverty in Africa despite the good economic performance of recent years, the expected effect of the implementation of the AfCFTA on poverty and income distribution is of critical importance. According to available figures, Africa has made significant progress in recent decades, reducing the extreme poverty rate by 13 percentage points between 1990 and 2015. However, due to population growth, the continent has, at the same time, recorded an increase in the number of people living in poverty from about 278 million in 1990 to 413 million in 2015. Thus, Africa's contribution to world poverty tends to increase so that, in 2015, 3 in 5 poor persons in the world lived in the African continent (Christiaensen and Hill, 2019)[1].

Most actors involved in the negotiations and implementation of this important initiative expect that it will be accompanied by a reduction in poverty and income inequality on the continent. Several mechanisms can justify the expected effect of the implementation of the AfCFTA on poverty and inequality. These include: (i) mechanisms related to changes in the remuneration of factors of production and the prices of goods and services; (ii) the effects on employment levels induced by economy-wide adjustments, and; (iii) changes in transfers resulting from changes in the incomes of certain economic agents such as the government, firms, and earnings of non-poor households that could worsen inequalities (Rivera and Rojas-Romagosa, 2007)[2].

A recent World Bank evaluation showed that the AfCFTA could have positive effects in terms of poverty reduction. The World Bank's results suggest that as much as 67.9 million people could be lifted out of poverty in 2035[3]. However, those results are assessed from the implementation of a reform that goes beyond strictly the AfCFTA Agreement and also considers measures to facilitate trade across borders within the multilateral framework of the WTO TFA-proven to generate the largest share of the impacts. As such, the effects of the sole AfCFTA reform on poverty reduction is expected to be significantly lower in reality.

[1] Christiaensen, L. and Hill, R. (2019). Poverty in Africa. In Beegle, K. and Christiaensen, eds. *Accelerating Poverty Reduction in Africa*. The World Bank, pp 32-50.

[2] Rivera, L. and Rojas-Romagosa, H. (2007). Free Trade Agreements, Poverty and Inequality in Central America. https://www.gtap.agecon.purdue.edu/resources/download/3458.pdf

[3] World Bank (2020).The African Continental Free Trade Area: Economic and Distributional Effects. https://openknowledge.worldbank.org/bitstream/handle/10986/34139/9781464815591.pdf?sequence=4&isAllowed=y

The objective of this study is to assess the impact of AfCFTA implementation on poverty and income distribution in Africa strictly in line with the content of the Agreement as it emerged from the negotiations.

2 Methodology

The methodological approach used is a sequential combination of a macro model with a microeconomic model. It is based on the technique developed by Tiberti, Cocowiez, and Cockburn (2017 and 2018)[4]. The macroeconomic model is the MIRAGE-e 1.1 model (Fontagne, Foure, and Ramos, 2013)[5]. This is a multi-sectoral and multi-regional dynamic computable general equilibrium (CGE) model able to capture the complex economic interactions taking place between economic agents and within and between countries and sectors. The model is calibrated using the GTAP 10 database. The GTAP 10 database gives us the ability to explicitly model 26 African countries with the rest of Africa being aggregated into six blocks of countries.

The microeconomic model is a microsimulation model using household survey data collected from AfCFTA member countries. It is part of the family of so-called behavioral micro-simulation models intensively used in the literature by authors such as Hérault (2006 and 2009)[6]. The analysis takes a sequential top-down approach for which changes in factors and goods prices are estimated through a CGE model and used to feed into the microsimulation model which represents individual households as described from the household survey data. In this way, the macroeconomic effects of AfCFTA are used to assess the potential impacts on poverty and income distribution from the trade reform. More precisely, the approach adopted is the one proposed by Tiberti, Cocowiez, and Cockburn (2017 and 2018). It has the advantage of being relatively simple to implement and takes into account the dynamic nature of the CGE model used. It has two components, namely: (i) the income generation module; (ii) the household consumption module.

The simulation scenario is cloasely following the agreed modalities by African member States under the AfCFTA reform in terms of trade in goods (with excluded, sensitive and non-sensitive lists)[7], commitments made on trade in services (through reduction of newly

[4] Tiberti, L., Cocowiez, M. and Cockburn, J. (2017). A Top-Down with Behaviour (TDB) Microsimulation Toolkit for Distributive Analysis. International Journal of Microsimulation (2018) 11(2) 191-213.
Tiberti, L., Cocowiez, M. and Cockburn, J. (2017). A top-down with behaviour (TDB) microsimulation toolkit for distributive analysis: A manual. PEP Toolbox

[5] See: http://www.cepii.fr/PDF_PUB/wp/2013/wp2013-39.pdf.

[6] Hérault, N. (2006). Building and Linking a Microsimulation Model to a CGE Model for South Africa. South African Journal of Economics Vol. 74:1 March 2006, pp. 34-58
Hérault, N. (2009). Les apports de la micro-simulation aux modèles d'équilibre général : application au cas de l'Afrique du Sud. Économie & prévision, n°187, 2009-1. pp. 123-135

[7] See http://www.cepii.fr/PDF_PUB/wp/2016/wp2016-20.pdf for previous work that has been updated to 2014 data.

computed ad-valorem equivalent of trade restrictions in services in Africa) as well as envisaged reduction in non-tariff measures.

2.1 The CGE model

To simulate the trade reforms under consideration in the FTAA, we adopted the MIRAGE (Modelling International Relationships in Applied General Equilibrium) model. This is a multi-sectoral and multi-regional dynamic computable general equilibrium model for trade policy analysis. Several versions of the model have been developed and applied in the study of trade reforms around the world (Bchir, Decreux, Guérin and Jean, 2002; Decreux and Valin, 2007; UNECA, 2013; Mevel, de Alba and Oulmane, 2015).

This section provides a brief description of the general structure of the model, focusing on the specificities of the model compared to other models found in the literature. It focuses particularly on the description of demand, supply, competition and market structure, model dynamics and closure.

Supply

The MIRAGE model version used in this study assumes that producers operate in a competitive environment. In each industry, the representative producer uses a nested function with several levels. Thus, the top level is represented by a Leontief-type technology combining value added and intermediate consumption, which includes all inputs. The value-added results from the combination of unskilled labor, land, natural resources and a composite factor through a CES function. The composite factor is a combination of skilled labor and a hybrid factor. The latter combines capital and energy using a CES function.

Within each country, primary factors are fully employed. Both installed capital and energy are assumed to be industry-specific. On the other hand, all other factors are mobile between sectors. Investment is allocated across sectors according to the return on capital. Skilled labor and energy are assumed to be perfectly mobile across sectors.

Demand

In each country or region, final consumption demand comes from a representative agent who maximizes a utility function under budgetary constraints. This agent allocates his income between savings and consumption expenditure. The distribution of consumption by product is modeled using an LES-CES function that assumes that the assumption of constant elasticity of substitution applies only to the excess of sectoral consumption over their minimum. This approach has the advantage of taking into account product differentiation by geographic origin and horizontal differentiation between varieties of the same origin (Bchir, Decreux, Guérin and Jean, 2002). To take vertical differentiation into account, an additional step is introduced into the demand function by distinguishing two different qualities according to the level of development of the country of origin of the good. Although this approach remains relatively basic, it does allow us to take into account the fact that competition between countries at a comparable level of development is more pronounced than that between countries at different levels of development. For more details, see Bchir, Decreux, Guérin and Jean (2002) and Fontagné, Fouré and Ramos (2013).

Capital, Investment and Macroeconomic closure

As mentioned above, installed capital is assumed to be immobile across sectors. The adjustment of capital stocks by sector occurs gradually as a result of investment. The determination of investment, whether of domestic or foreign origin, is carried out using a unique formulation. It depends on the initial structure of savings, the current capital stock and the sectoral rate of return on capital. The model includes two types of foreign direct investment (FDI): the acquisition of existing firms and the creation of new firms. While both types have the same impact on the capital stock, their consequences are different when considering the number of firms in the host country. In this version, the investment model is based on the assumption that FDI responds to an industrial logic. As a result, the macroeconomic closure assumes that the capital balance excluding FDI is exogenous. It is fixed at its value in the base year. The current account balance therefore depends on the net FDI flow.

Data and scenario of simulation

The model will be calibrated based on the GTAP 10 database which includes 65 sectors of activities and 131 regions. Considering the limitations of the solver, we aggregated regions and sectors of activities. The geographical and sectoral aggregation will take into account the quality of the data and the priority sectors in the economic and social development of the African continent. In this paper, 30 regions and 29 sectors were selected. Among the 30 regions, 18 are African countries, members of the AfCFTA, which were modeled individually[8]. The other 12 include four blocks of African countries: the rest of ECOWAS, the rest of North Africa, the rest of ECCAS and other African countries. In the total of 30 activities, we consider eight (8) agrifood sectors, eight (8) industrial manufacturing, six (6) energy production sectors and, eight (8) service sectors.

2.2 The microsimulation model

[8] Egypt, Morocco, Benin, Cameroon, Cote d'Ivoire, Ghana, Nigeria, Senegal, Ethiopia, Kenya, Mauritius, Mozambique, Rwanda, Tanzania, Uganda, Zimbawe, Namibia, South Africa.

This section is devoted to a brief description of the microsimulation model that is linked to the computable general equilibrium model presented in the previous section. Our approach falls within the family of behavioral microsimulation models used in the literature by authors such as Hérault (2006 and 2009), Tiberti, Cocoweiz and Cockburn (2010), Lay (2018).

The approach adopted is the one proposed by Tiberti, Cocowiez and Cockburn (2017 and 2018). It has the advantage of being relatively simple to implement and takes into account the dynamic nature of the computable general equilibrium model used. It has two components, namely: (i) the income formation model and (ii) the household consumption model. The following sections briefly present these two components. For a detailed presentation of the approach, the reader may refer to Tiberti, Cocowiez and Cockburn (2017).

Income Generation Model: Employment and income

The development of this module consists mainly of formalizing a process for household income generation. This process assumes that individuals derive their income mainly from the remuneration of their labor force and other primary factors of production, to which are added other exogenous incomes, such as transfers and rents like rental income. The generation of household income involves an occupational choice model and an earnings model. The former determines the choice of individual agents of being a wage earner or a self-employed worker. The second estimates household income.

The occupational status

Generally, household databases available in African countries do not record the number of hours worked, so the treatment of individuals' labor supply is captured by a discrete variable that indicates their choice among many alternatives. Thus, the employment status of individuals or households can be broken down into four modalities: employees, non-agricultural self-employed workers, farmers, and the inactive. Thus, this configuration, the choice of a given individual can be modeled by a discrete multinomial choice function. As in Tiberti, Cocowiez and Cockburn (2017), the labor supply will be estimated separately by category of worker based on the level of qualification. Two categories are thus considered: skilled workers (those who have completed primary education) and unskilled workers (those who have never been to school or have not finished elementary school). Besides, working individuals can be classified into three categories: (i) salaried workers, (ii) non-agricultural self-employed, or (iii) farmers. From one period to another, each individual can change category according to the usefulness of being in one or other of the different categories.

Using this approach, the probabilities associated with each employment status can be estimated and a new status can be assigned to each individual or household in the survey sample based on their characteristics. The assignment of employment status using the approach of Tiberti, Cocowiez and Cockburn (2018) is based on a "job queue" phenomenon. Individuals who move from one alternative to the other are selected according to their probability of being in the relevant occupational category.

The households' profit

Profit represents the income from agricultural or non-agricultural activities of self-employed workers in these sectors. It is estimated using an instrumental variable method. This choice is justified by the fact that some explanatory variables (such as the number of family workers) may be endogenous and therefore correlated with the error term.

The estimated profit function is a Cobb-Douglas function. The error term is recovered both for households with zero reported profit in the base year and those with negative reported profit in the base year. After the simulations, only the deterministic component of the model is recalculated (using the regression parameters estimated at the base year). The estimated household profit (including residual terms) is finally divided by the total number of household members (skilled and unskilled) working in the agricultural or non-agricultural sector.

The total households' income

Unlike Lay (2018), the approach chosen determines the income generation of the household head and other household members in the same way. The equation is as follows:

$$Y_{h,t} = \sum_{i=1}^{N} \sum_{s=(H,L)} w_t^s \, I(E_{i,t}^s = 1) + \sum_{j=(F,NA)} \pi_{h,t}^j + y_{h,t}^e$$

$Y_{h,t}$ indicates the total income of household h at time t. The index i denotes the individual in household h and N stands for the number of working persons in the household. It is derived from wage income, profits of self-employed workers, and exogenous income.

The set s refers to the level of qualification with (s=H) if the individual is a skilled worker and (s=L) if the individual is an unskilled worker.

The function $I(.)$ indicates the professional status of individual i at time t. It follows that $E_{i,t}^s = 1$ if the individual i, with qualification s, has a paid job at time t and $E_{i,t}^s = 0$ if not.

The index j, is relative to the sector of activity of the self-employed of the household and it takes the values F for the agricultural sector and NA for the non-agricultural sector and $\pi_{h,t}^{j}$ represents the profit of the household h, at time t from sector j.

$y_{h,t}^{e}$ denotes the exogenous part of the total income of household h at time t.

Thus, the first component of the right-hand term in this equation refers to household wage income, the second is the total profit from self-employment activities in the agricultural and non-agricultural sectors of household members, and the last represents exogenous sources of income such as private and/or public transfers received by the household.

Household consumption and prices

Poverty and inequality are measured by using the real consumption expenditure of households in each period. The level of consumption is obtained from the per capita income estimated in the module above. The process is done in several steps. Thus, we have:

- Step 1: Reclassify the products and services in the survey's household consumption basket into the same categories as those in the social accounting matrix of the computable general equilibrium model ;
- Step 2: To take into account the heterogeneity of the effect of prices on household consumption, establish a consumer price index for each household in the survey. The price index is used as a deflator to calculate an equivalent income according to King's (1983) approach;
- Step 3: the equivalent income calculated in step 2 captures the heterogeneity of households in terms of well-being.

The equivalent income vector is used to conduct the estimation of all standard poverty and inequality indices.

3. Presentation and analysis of results

To be completed

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