Analysis of AfCFTA Impacts on Agri-Food Sub-Sectors and Food Security in Cote d'Ivoire

Souleymane S. DIALLO[a], Assion LAWSON SIPOAKA [a], Victor NECHIFOR[b], Antti SIMOLA[b], Ole BOYSEN[b] et Emanuele FERRARI[b]

[a]Centre Ivoirien de Recherches Economiques et Sociales (CIRES)

[b]Joint Research Centre (JRC)

Abstract:

The main objective of this paper is to quantify the impact of the implementation of the AfCFTA on the agri-food sub-sectors and food security in Côte d'Ivoire. To this end, it combines a dynamic computable general equilibrium model and a microsimulation model, calibrated respectively with a disaggregated social accounting matrix of the Ivorian economy and the 2021-2022 harmonized household living conditions survey. The results indicate that implementation of the AfCFTA will have a positive impact on Côte d'Ivoire's economic growth and foreign trade. However, tariff dismantling will result in lower customs revenues, with a negative impact on public finances. On the other hand, the increase in agri-food imports, the improvement in agricultural production and the decrease in consumer prices will help to reduce food poverty and improve household well-being.

Key Words: AfCFTA – CGE dynamic Model – Agri-food – Food Poverty – Côte d'Ivoire

JEL Classification : F15, D58, O13, I3, O5

1. Introduction

In January 2021, the member countries of the African Union launched the African Continental Free Trade Area Agreement (AfCFTA), creating the world's largest free trade area regarding the number of member countries. The main objective of this agreement, which marks a decisive turning point in the continent's integration process, is to boost intra-African trade and contribute to member countries' economic growth and social and economic development.

With real GDP growth averaging 8.2% over the 2012-2019 period, Côte d'Ivoire has managed to contain the COVID-19 pandemic and maintain positive growth in 2020 at 2% (World Bank, 2024). In 2021, the country resumed its strong growth trajectory and continues to play a central role as a regional economic hub, recording a growth rate of 6.5% in 2023.

Despite this strong performance, Côte d'Ivoire trades relatively little with the African continent. Indeed, national data show that Africa's share of the country's total exports fell from 32% in 2010 to 23% in 2023, while at the same time, Africa's share of total imports fell from 34% in 2010 to 25% in 2023. In addition, the country remains a major agricultural producer but still depends on imports of cereals, beef, and fishery products, which poses a real challenge for the future.

This study aims to: (i) assess the macroeconomic impacts of implementing the Agreement, (ii) quantify the sectoral impacts with a focus on the agri-food sectors, and (iii) determine the effects on household welfare and food security.

2. Background

2.1 Performance macroéconomique, commerce extérieur

Since the end of the political crisis in 2011, Côte d'Ivoire has been one of the fastest growing economies worldwide. Gross domestic product (GDP) grew annually by 8.2% from 2012 to 2019. Amid Covid-19 in 2020, GDP grew by 2%, backed up by years of strong economic fundamentals post-conflict and rapid policy response. GDP is forecast to grow by up to 6.5% in 2021, and up to 7.7% annually until 2025.

An oversight of the country's foreign trade reveals that, in recent years, imports have outstripped exports, resulting in a situation where its traditional trade surplus turned into a deficit in 2022. According to Côte d'Ivoire customs statistics, the country's imports rose by 44.2% in 2022,

mainly due to a significant increase in the price of imported goods in general, and crude oil in particular. At the same time, exports rose by 19.9% in 2021. Furthermore, the data reveal that Côte d'Ivoire's leading customer is Mali, which accounts for 8.9% of its total value exports. It is followed by the Netherlands (8.7%), Switzerland (8.1%), the USA (5.3%) and Burkina Faso (5.1%). As for imports, foreign trade data show that China has been the country's most important trade supplier since 2016 (accounting for 14.4% of total imports).

The analysis shows that Côte d'Ivoire's trade balance is structurally in positive. Indeed, with the notable exception of the year 2022, when a trade deficit of 811 billion FCFA was recorded, the trade balance has always been in excess. However, over the period 2010-2023, the surplus has shown a downward trend, falling from 1182 billion FCFA in 2010 to just 10 billion in 2023.

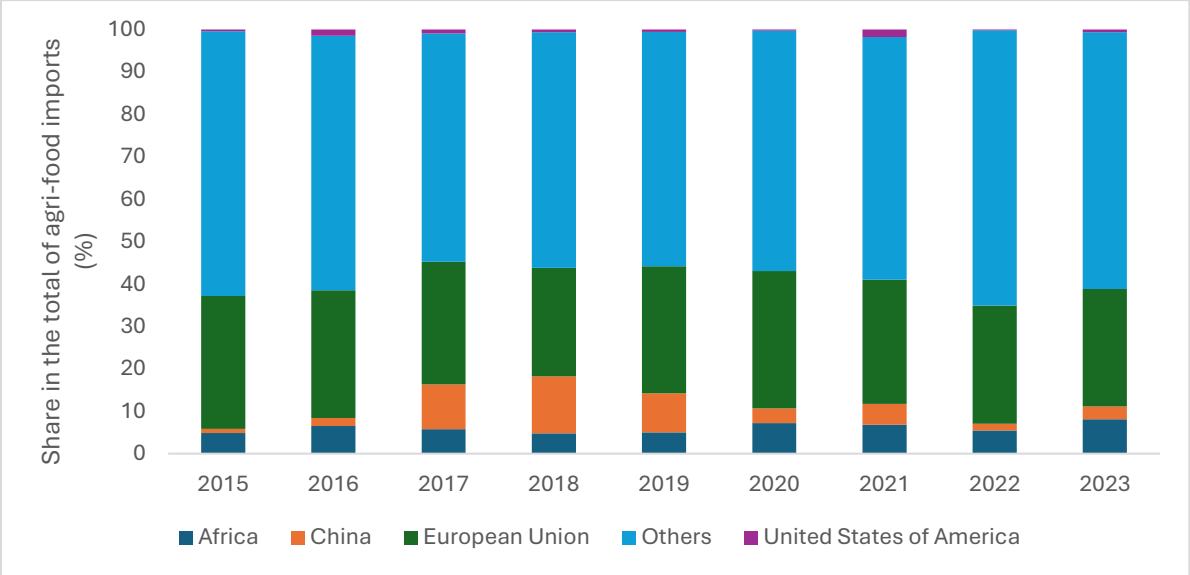
While Côte d'Ivoire is a net exporter of goods, Raga (2022) has shown that the value of the country's exports relative to GDP has been on a downward trend in recent years, falling from 25.6% to 20.1% from 2015 to 2020. This was been driven by reduced export value of Côte d'Ivoire's cocoa (a major export). The Ivorian exports are dominated by cocoa, cashew nuts, gold, oil, rubber and cotton but there is room to support exporting of soap, chocolates, coffee extracts, bananas and cosmetics in view of increasing world demand of and/or Ivorian efficiency on these products (Raga, 2022).

Despite its economic success, Côte d'Ivoire faces persistent challenges in achieving food security. While agricultural exports contribute significantly to GDP, much of the population remains dependent on subsistence farming and is vulnerable to food price volatility, climate change, and limited access to modern farming inputs. The country also relies on food imports for staples such as rice, wheat, and maize, making it susceptible to external shocks.

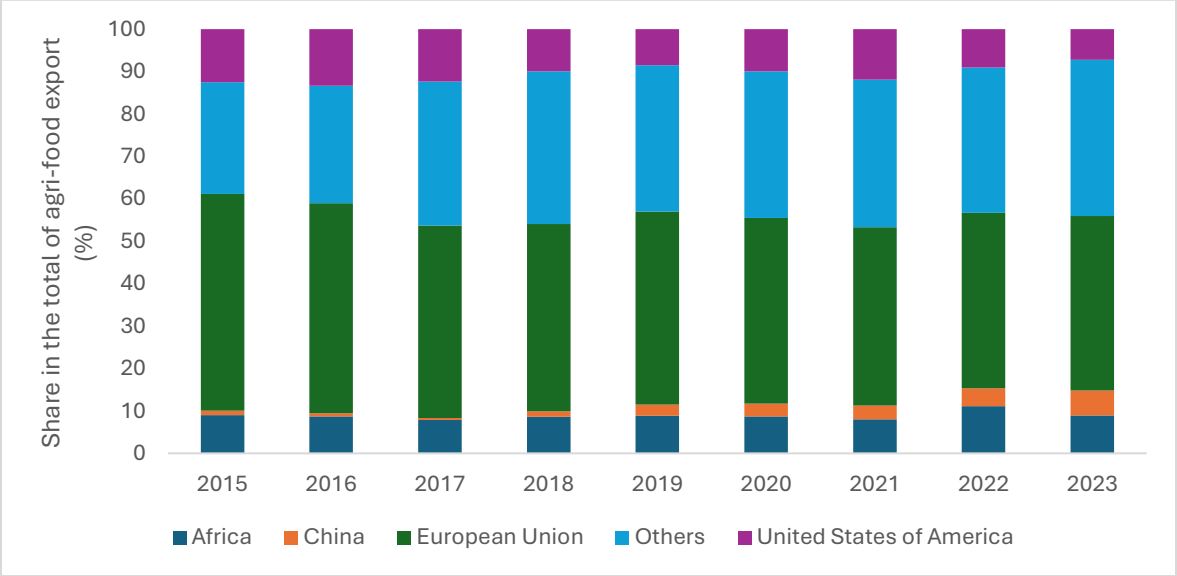
Despite its agricultural potential, Côte d'Ivoire depends, at least in part, on the outside world to satisfy its agri-food needs. According to FAO figures, the country's agri-food imports exceeded 3 billion Amerocan dollars in 2023, i.e. nearly 4% of GDP. Based on available data, the European Union remains the country's main supplier, even though its share of the country's total agricultural and food imports has been declining in recent years (Figure 1). Indeed, over the period 2015-2023, the EU's share of Côte d'Ivoire's agricultural and food imports hovers around 29%, evolving from 31.31% in 2015 to 27.69% in 2023. Over the same period, Africa's share has recorded a significant increase, even though it is still low. It has risen from 4.83% in 2015 to 8.1% in 2023, almost double the initial share.

Figure 1 : Share of major partners in total agri-food trade of Côte d'Ivoire

A: Share of major partners' in Côte d'Ivoire's total agri-food imports



B: Share of major partners' in Côte d'Ivoire's total agri-food exports



Source: Authors' calculation from FAOSTAT Database.

In terms of exports, the African continent remains a significant customer for agricultural and food exports. Over the period 2015-2023, Africa's share of Côte d'Ivoire's agri-food exports is estimated, on average, at around 9%. However, Africa's share remains lower than that of the USA, which has an average share of 10.53%. As for imports, the European Union is by far the

biggest client, with an average share of around 45%, dropping from 51.08% in 2015 to 41.15% in 2023.

The AfCFTA's implementation is expected to transform agricultural markets by increasing regional trade flows, encouraging specialization, and improving access to food. However, there are concerns about the impact on smallholder farmers, who may face increased competition from larger producers in other African countries. Additionally, the liberalization of food markets may affect the affordability and availability of key staples, with implications for the most vulnerable populations.

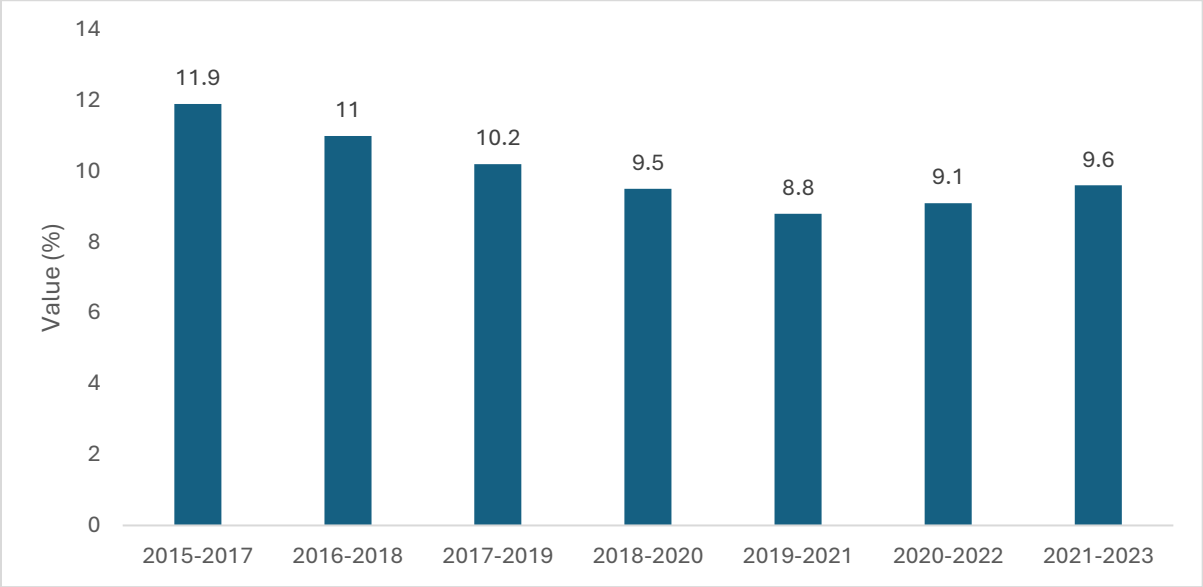
2.2 Undernourishment and food insecurity

Reducing undernourishment and food insecurity is a priority concern in Côte d'Ivoire. This concern is clearly reflected in the national agricultural policy reference document, the second National Agricultural Investment Programme (NAIP – 2018-2025), which is the national translation of the African Union's CAADP initiative. It aims to support the development of Productivity and sustainable development of agro-sylvo-pastoral production through the adoption of innovative technology and infrastructure promoting both productivity and competitiveness, while preserving the environment. Program 1 of NAIP 2 encourages the use of sustainable agricultural production techniques and integrated production systems combining agricultural and pastoral sectors, such as agroforestry, coffee-growing-apiculture or cashew-growing-apiculture. The government's strategy aims to:

- maintain an average annual growth rate in agricultural production of 7.5% over the 2021-2025 period;
- improve yields of the five (05) main food crops (cassava, maize, plantain, yam, tomato);
- promote the transformation of 25% of maize production by 2025;
- improve yields per hectare of the main cash crops (cocoa, rubber, cashew nuts, cotton, mango) and;
- encourage the processing of export crops.

Successive efforts for agricultural development in Côte d'Ivoire and the promotion of sustainable access to food have reduced the rate of undernourishment, as shown in figure 2.

Figure 2 : Prevalence of undernourishment (3-year average)

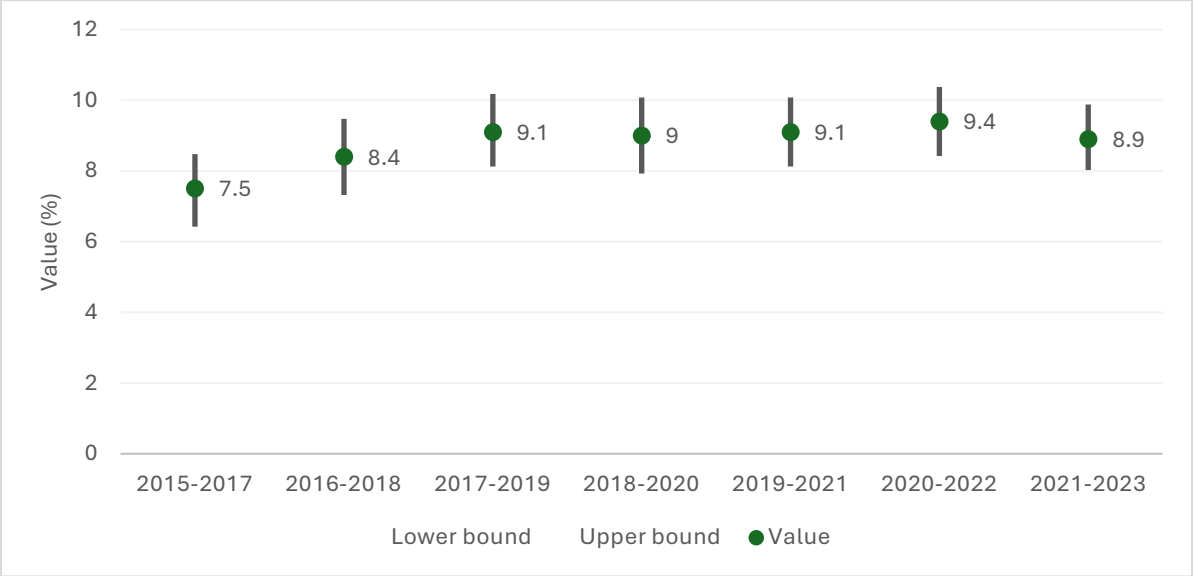


Source: Authors' calculation from FAOSTAT Database.

According to FAO figures, the undernourishment rate has fallen from 11.9% in 2015-2017 to 9.6% in 2021-2023. While the overall trend is downwards, the curve is reversed from 2019-2021 onwards. Indeed, the undernourishment rate will increase from 8.8% to 9.6% in 2021-2023. This change can certainly be partially attributed to the COVID19 pandemic in 2020.

As far as food security is concerned, the available data indicate that the situation has worsened since 2015 (Figure 2).

Figure: Prevalence of severe food insecurity in the total population (percent) (3-year average)



Source: Authors' calculation from FAOSTAT Database.

The prevalence of severe food insecurity rose over the 2015-203 period. It increased from 7.5% in 2015-2017 to 8.9% in 2021-2023, with a peak of 9.1% in 2017-2019 and 2019-2021. This could be explained by trends in consumer prices, difficulties in the agricultural sector due to the drought episodes the country has experienced, and the COVID19 pandemic, which disrupted supply circuits both locally and internationally.

Addressing food security within the context of AfCFTA is imperative for Côte d'Ivoire's development agenda. This requires a synergy of actions in the implementation of the AfCFTA, taking into account the African Union's CAADP initiative. This should help boost farmers' incomes, create jobs and facilitate access to food products in sufficient quantity and quality to ensure food security.

3. Literature Review

The economic literature provides a wide range of studies on the impact of the AfCFTA. These studies can be found at both continental and country level. Already in the early 2010s, the United Nations Economic Commission for Africa had started to work on the potential impact of setting up a continental free trade zone in Africa with the studies by Mevel and Karingi (2012 and 2013). These works appear as pioneers in thinking about what greater integration formulated within the framework of a continental free trade zone could bring to African

economies. Using a global computable general equilibrium model, they showed that the establishment of a continental free trade zone could have a positive impact on economic growth, the strengthening of intra-African trade and well-being, as long as efforts could go beyond tariff elimination to include the reduction of non-tariff barriers.

Following this work, several studies have been devoted to this topic using a variety of economic analysis tools. While some authors use econometric methods (Fofack, Dzene and Hussein, 2021; Geda and Yimer, 2022), others employ partial equilibrium simulation models (Bayale, Ibrahim and Atta-Mensah, 2020). But for most of the authors, the use of computable general equilibrium models predominates.

Geda and Yimer (2022) conducted an assessment of the impact of a tariff reduction on intra-African trade under the AfCFTA, combining the use of trade indices with a gravity model. Their estimates suggest that this could increase intra-African exports by 19%. The authors suggest that the success of such a policy depends not only on tariff reductions, but also on the adoption of a genuine industrialization strategy in tandem with tariff dismantling.

Bayale, Ibrahim and Atta-Mensah (2020) estimated the potential impacts of implementing the AfCFTA in Ghana using the WITS-SMART partial equilibrium simulation model. Their assessment indicates that implementation of the Agreement could result in a substantial increase in Ghana's foreign trade and an improvement in household welfare. With potentially larger effects on exports, the authors indicate that the country's trade balance could improve. However, Ghana could experience a significant drop in customs revenues.

Using a pseudo-maximum likelihood general equilibrium model augmented by dynamic capital accumulation, Fofack and Dzene (2021) estimate the effects of the AfCFTA on intra-African trade flows. Their results indicate that implementation of the AfCFTA could increase intra-African trade by 24% in the short term and slightly more in the long term. However, according to their estimates, the impacts per country will not be uniform. Trade and welfare gains could be relatively greater for countries with low levels of intra-African trade and regional integration pre-ZLECAf.

All these studies, while useful and rigorous from a methodological point of view, share an intrinsic limitation: given their level of aggregation, they cannot account for the impact on sectoral allocation of resources, nor on distributional effects and poverty impacts. This is the main reason why most authors tend to choose computable general equilibrium models, which offer greater flexibility in terms of sectoral and institutional disaggregation.

A review of studies using computable general equilibrium models to analyze the impact of the AfCFTA reveals two categories of model. These are multi-country models and country models. In the first category, which follows on from the work of Mevel and Karingi (2012 and 2013), we can cite studies by the World Bank (2020), Abrego et al. (2019), Simola et al. (2022) and Bakouan, Diarra and Ouedraogo (2024), among others.

Calibrated using the GTAP database, they generally simulate the elimination of tariffs applied to intra-African trade on the one hand, and the elimination of these tariffs combined with a reduction in non-tariff measures. Abrego et al. (2019) use a multi-country, multi-sector computable general equilibrium model to estimate the welfare impact of the AfCFTA for 45 African countries. The results indicate that the Agreement could generate significant welfare effects. However, as the initial level of tariff protection is relatively low due to previous economic policy reforms, intra-African import's tariffs liberalization alone could have limited impacts. To improve results, it is important to couple tariff reduction with a reduction in NTM barriers.

By combining the computable general equilibrium model with the global microsimulation model GIDD[1] (Bussolo, Hoyos and Medvedev, 2010), the World Bank (2020) study shows that the impact of implementing the AfCFTA will have a positive impact at continental level, with a significant increase in intra-African trade and significant spillover effects in terms of economic growth and a reduction in extreme poverty.

Simola et al (2022) investigate the impact of the ZLECAf using the Modular Applied GeNeral Equilibrium Tool (MAGNET) described in Woltjer et al (2014). This is a computable global general equilibrium model. Their results indicate that implementation of the AfCFTA would result in a positive impact on economic growth, trade and welfare. Using a similar methodology with a global computable general equilibrium model, Bakouan, Diarra and Ouedraogo (2024) find similar results for East African countries.

The use of global computable general equilibrium models appears to be a necessity in order to capture the interactions between AfCTA member economies and take into account the export opportunities resulting from the simultaneous application of tariff concessions. However, they have two major limitations when it comes to individual economies. Firstly, it is difficult to simulate country-specific policies in order to address some negative effects such as tariff revenue losses or negative impacts on certain country-specific economic sectors. Secondly, they

[1] Global Income Distribution Dynamics (GIDD)

are difficult to use to carry out a detailed analysis of the redistributive impact of the Agreement, particularly when we are interested in the effects at the level of a given country's regions.

To overcome these limitations, Nechifor et al (2022) and Maskaeva et al (2024) coupled a global computable general equilibrium model using the GTAP database with a country model calibrated with a national accounts matrix disaggregated to region level. Nechifor et al (2022) applied this approach to Kenya, and Maskaeva et al (2024) to Tanzania, to assess the impact of the AfCFTA on these two countries. By combining the MAGNET model (Woltjer et al., 2014) and the DEMETRA model, they achieve results that confirm the positive effect of the Agreement's implementation, and provide more detailed results at national level.

The literature review provides us with two important lessons: (i) the first is that there is very little information on the implications of the AfCFTA on food security, and (ii) the second is the absence of studies specifically devoted to Côte d'Ivoire.

To the best of our knowledge, there are very few studies addressing the issue of food security in the context of the AfCFTA. Simola et al (2022) are the only authors to have addressed the question in terms of the food security impact of implementing the Agreement. Using a global computable general equilibrium model, they have carried out a rigorous assessment of the impact of the AfCFTA on agricultural and agri-food production, imports, food prices and household consumption and welfare. They demonstrated that the implementation of the Agreement could pull 1 million people out of the risk of hunger, and that it would result in an increase in national incomes compared to the scenario without the AfCFTA. On a continental scale, their study shows that food production is increasing overall. However, some countries could face a drop in production, which would be replaced by rising imports.

Moreover, to our knowledge, there are no studies to date specifically devoted to the impact of the AfCFTA on the Ivorian economy. However, some studies on the subject do provide information on Côte d'Ivoire. Such is the case of the World Bank's assessment (2020). This study shows that full implementation of the AfCFTA could induce a real income gain of around 13% for Côte d'Ivoire, compared to the scenario without the AfCFTA. Similarly, the country's share of intra-African exports could increase by 9% under the “tariff reduction” scenario, compared with an increase of 36% under the “tariff reduction+NTM” scenario in 2035.

4. Methodology

The methodological approach is an extension of Simola et al (2022), Nechifor et al (2022) and Maskaeva et al (2024). It combines three analytical tools enabling a rigorous assessment of the impact of the implementation of the AfCFTA on the Ivorian economy. The combination of tools is based on a top-down approach. At the first level, we use the global computable general equilibrium model MAGNET to simulate the implementation of the AfCFTA. The results of this model are used to feed the DEMETRA model, which is calibrated using a social accounting matrix of the Ivorian economy (Ferreira et al., 2021) to provide a more detailed analysis of the impact of the AfCFTA at national and sub-national levels. At the lower end of the scale, the results of the DEMETRA model are used as input to a microsimulation model. After providing a brief description of these three models and their articulation, this section presents the data used and the simulation scenarios.

The use of the MAGNET model was made necessary by the fact that the AfCFTA is applied at the level of all countries party to the agreement, so that by liberalizing its market to the benefit of its African partners, Côte d'Ivoire benefits from a reciprocal measure on the part of the other African countries, giving it preferential access to these markets. This cannot be adequately captured by a single-country computable general equilibrium model. To overcome this limitation, the application of the AfCFTA at continental level is simulated using the MAGNET model, which provides information on the consequences for export quantities and international export prices on the one hand, and international quantities and international import prices on the other. This information is used to feed the DEMETRA computable general equilibrium country model. For more details on the link between the two models and the rationale behind this approach, readers can consult de Nechifor et al. (2022) and de Maskaeva et al. (2024).

To assess the impact of the implementation of the Agreement on food security at household level, we extended the work of Nechifor et al. (2022) and Maskaeva et al. (2024) by combining the approach of Pauw and Thurlow (2011) and Diallo et al. (2020). Pauw and Thurlow (2011) propose the combination of a regionalized computable general equilibrium model and a microsimulation model to analyze the link between economic growth and nutrition in Tanzania. The main innovation of their approach lies in the way in which caloric consumption measured from the consumption basket obtained via the household survey is linked to the variation in consumption generated by the general equilibrium model. Using this approach, we determine household consumption from the 2021-2022 Harmonized Household Survey on Living Conditions (EHCVM), and link it to the information provided by DEMETRA. The EHCVM is

a nationally representative survey of 13,000 households, which are also representative of the geopolitical zones (at both the urban and rural level).

The caloric consumption vector is used in the microsimulation model applied to the Ivorian economy by Diallo et al. (2020). Our microsimulation model belongs to the family of non-parametric models. It uses a reweighting technique based on the cross-entropy (CE) principle. In concrete terms, it is based on the minimization of the Kullback-Leibler cross-entropy measure. In other words, it seeks to minimize the distance between the probability distributions of caloric consumption volumes of posterior (w) and anterior (v) data as proposed by Lee and Judge (1996).

Formally, it is as follows (Fofana, Chitiga-Mabugu and Mabugu, 2018):

$$Min\ \Omega = \sum_i w_i . ln\frac{w_i}{v_i} \quad (1)$$

Avec $\sum_i w_i = 1$

Kullback-Leibler cross-entropy also called Kullback-Leibler divergence measures the dissimilarity between posterior and anterior distributions (Herbulot, 2007) given aggregate data on population growth and urbanization. With θ representing the urbanization rate; u is the proportion of the rural population in the total population ($u \subset i$) we note that:

$$\sum_u w_u = \theta \quad (2)$$

The methodological approach used is based on the assumption that all incomes at individual level and the resulting consumption behavior are observed in the household survey. The probabilities associated with each income category are expressed by weights assigned to each individual surveyed. Considering caloric consumption volume per adult equivalent (Y) and individual consumption yi, we have:

$$\bar{Y} = \sum_i w_i . \bar{y_i} \quad (3)$$

Food poverty is measured by the incidence of poverty proposed by Foster, Greer and Thorbecke (1984), which refers to the proportion of the population below a given daily calorie consumption threshold. In this study, we used the daily caloric consumption of 20100 kcal given by FAO (2019).

Food poverty is measured by the incidence of poverty proposed by Foster, Greer and Thorbecke (1984), which refers to the proportion of the population below a given daily calorie

consumption threshold. In this study, we used the daily calorie consumption of 2100 kcal given by the FAO (2019).

The food products in SAM are matched with those in the harmonised survey. Then, we retrieved the caloric values corresponding to the food products consumed from the West African food consumption table (Vincent et al., 2020)[2]. From the household survey, we have the household consumption volume by product, household size and other socio-demographic characteristics. The volume of food consumption is expressed as the equivalent of an adult male and standardised to take account of spatial disparities. The sum of the calories associated with the products consumed is compared with the selected calorie threshold. Any household whose calculated calorie value is below the threshold is poor. Our approach draws on the work of Pauw and Thurlow (2011) and Sands and Beach (2022).

Denoting by P_z, the poverty rate following the food poverty line z and pi, the poverty status of individual i, we note:

$$\bar{P_z} = \sum_i w_i \bar{p}_{i,z} \,.\, i(\bar{y}_i < z) \qquad (4)$$

Two scenarios for implementing the AfCFTA were simulated. The first simply applies the elimination of customs duties on intra-African imports as agreed in the results of the negotiations between the States parties to the agreement (Tariff). The second combines the elimination of customs duties on imports with a 50% reduction in non-tariff measures on intra-African trade in goods (Tariff+NTM).

5. Simulation results

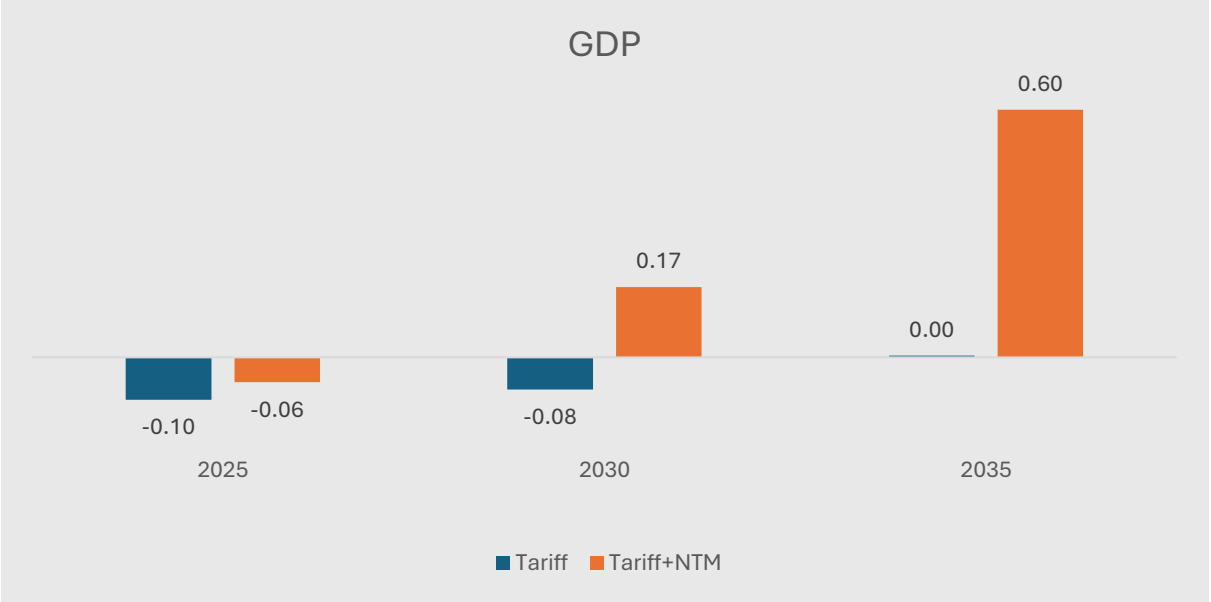
This section outlines the macroeconomic and sectoral impacts of implementing the AfCFTA, as well as the impacts on household welfare and food poverty.

5.1 Macroeconomic and sectoral impacts

Figure 3 shows the impact on Côte d'Ivoire's GDP of the two simulation scenarios.

[2] https://www.fao.org/infoods/infoods/tables-and-databases/faoinfoods-databases/en/

Figure 3: Impact on GDP



Source: Simulation results

The results indicate that the simple elimination of customs tariffs (Tariffs) as a result of the negotiations will have small but overall negative effects for Côte d'Ivoire. This is particularly true in the first few years of the Agreement's implementation. However, the situation will improve over time. Conversely, the elimination of tariffs coupled with a 50% reduction in intra-African trade NTMs (Tariffs+NTMs) will have a positive impact overall. In the short term, the effect will be negative, but the situation will improve over time.

Cette évolution s'accompagne d'un impact positif sur les importations et les exportations.

Figure: Impact of the AfCFTA on customs revenues by scenario

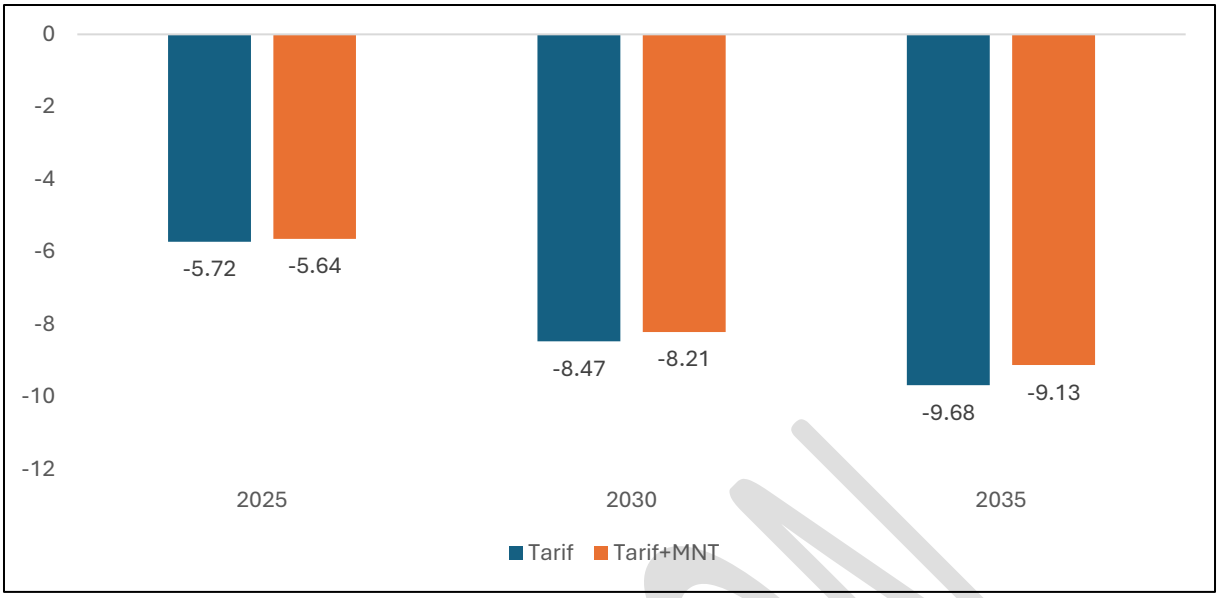


Figure: Impact of the AfCFTA on the government's total income by scenario

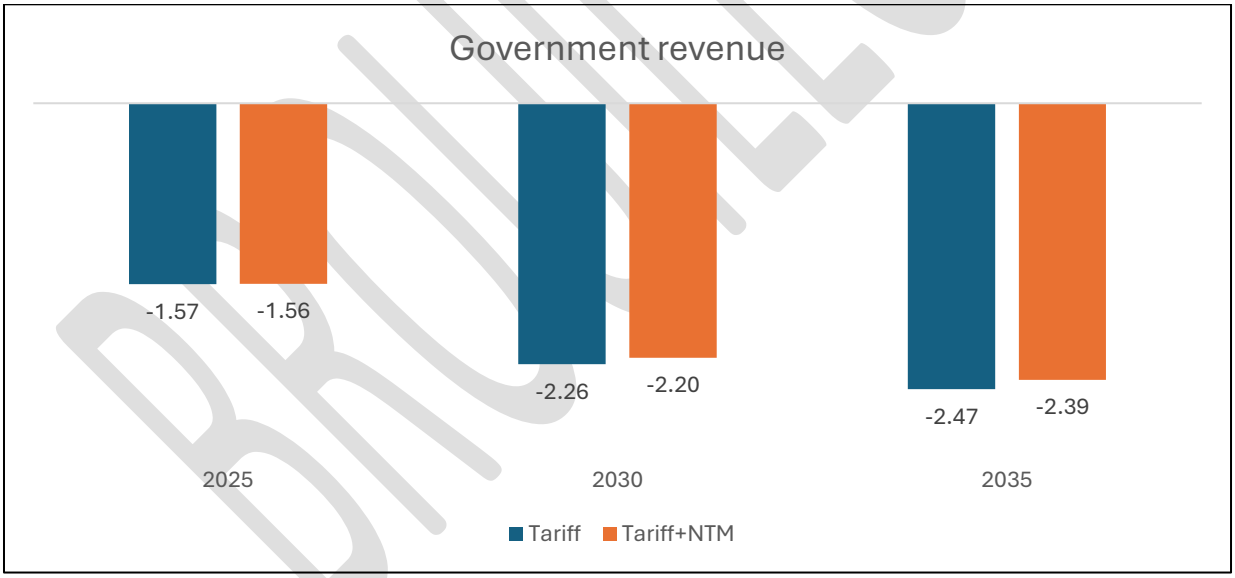


Table xx: Impact on agriculture and food production by scenario

	Tariffs			Tariffs + NTM		
	2025	2030	2035	2025	2030	2035
Agriculture	0,03	0,12	0,11	0,06	0,07	0,09

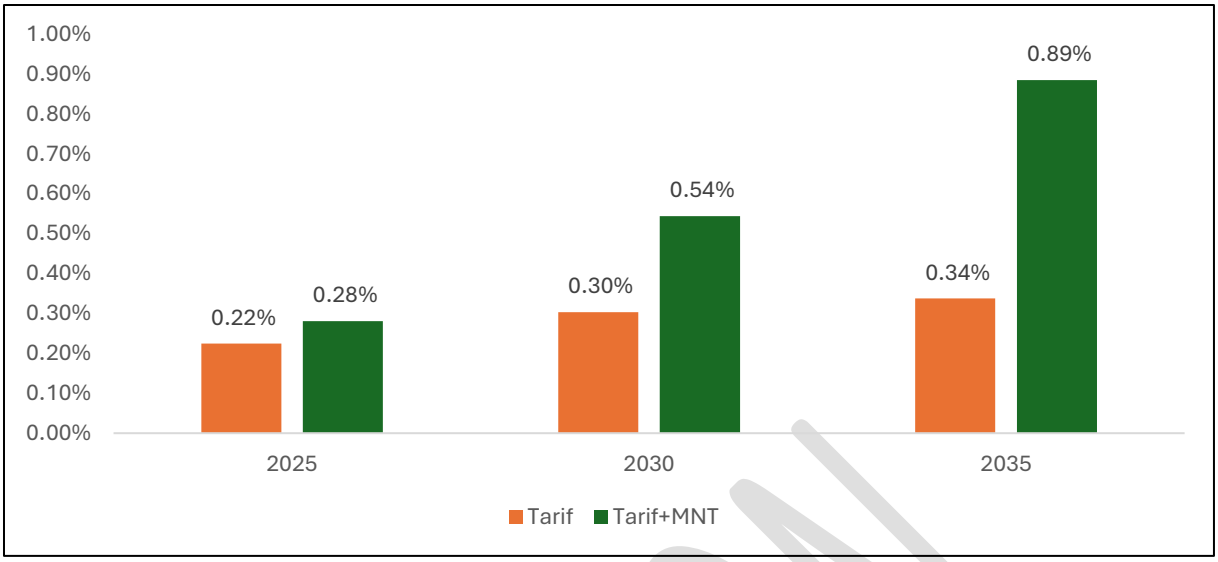
Fishing	-0,20	-7,46	-4,55	-10,67	-8,10	-4,05
Processed food products	0,05	-0,06	0,17	-0,52	-0,41	-0,89

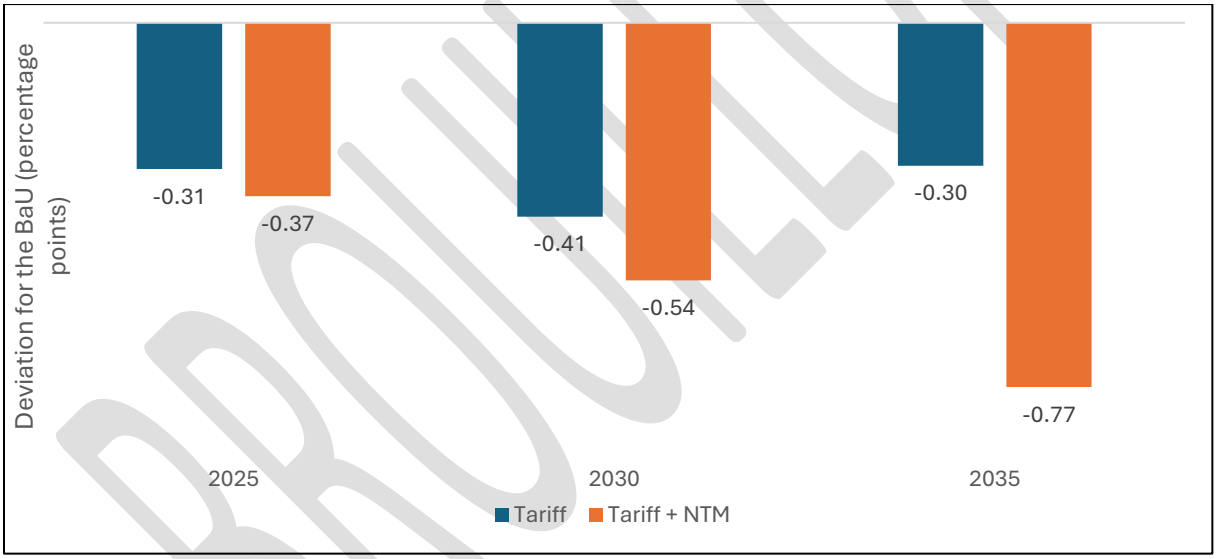
Table xx: Impact on agriculture and food imports by scenario

	Tariffs			Tariffs + NTM		
	2025	2030	2035	2025	2030	2035
Food crops	-0,80	-0,92	-0,71	-0,20	1,12	3,37
Cash crops	-0,33	-0,26	-0,34	-0,28	-0,29	-0,58
Livestock, meat and fishing	-9,44	-6,32	-3,10	-9,44	-6,28	-3,04
Processed food products	3,57	3,20	2,65	3,51	2,75	1,84

5.2 Impact on Households' welfare and food poverty

Figure: Impact of the AfCFTA on household welfare by scenario


1.00%
0.90%
0.80%
0.70%
0.60%
0.50%
0.40%
0.30%
0.20%
0.10%
0.00%
0.22%
0.28%
0.30%
0.54%
0.34%
0.89%
2025
2030
2035
Tarif
Tarif+MNT


Deviation for the BaU (percentage points)
-0.31
-0.37
-0.41
-0.54
-0.30
-0.77
2025
2030
2035
Tariff
Tariff + NTM

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