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RESEARCH ARTICLE

Impact of China–Africa agricultural trade on food security: facts and quantitative analysis

Zhendong MA*[1], Rui WANG*[1], Faqin LIN[1,2], Qianqian ZHANG (✉)[1], Kofi OTUMAWU-APREKU (✉)[3,4]

1 College of Economics and Management, China Agricultural University, Beijing 100083, China.
2 Academy of Global Food Economics and Policy, China Agricultural University, Beijing 100083, China.
3 Department of Fisheries Studies, Faculty of Agriculture, Fisheries & Forestry, Solomon Islands National University, Honiara 999197, Solomon Islands.
4 Institute for Oceans, Islands & Sustainable Development, Solomon Islands National University, Honiara 999197, Solomon Islands.

*These authors contribute equally to the work

KEYWORDS

Agricultural trade, China–Africa cooperation, food security, welfare

HIGHLIGHTS

- Structural multi-country modeling quantified significant welfare gains from China–Africa agricultural trade liberalization, with African countries achieving up to 18.8% welfare improvements.
- Trade barriers and logistics inefficiencies contribute to untapped export potential in Africa; infrastructure and policy coordination are critical for equitable benefits.
- China's diversification into processed goods and Africa's high-value exports (e.g., coffee and cocoa) emerge as dual drivers for sustainable food security.
- Targeted strategies, including sanitary and phytosanitary harmonization and climate-resilient practices, are proposed to align trade growth with the UN SDG 2 (Zero Hunger).

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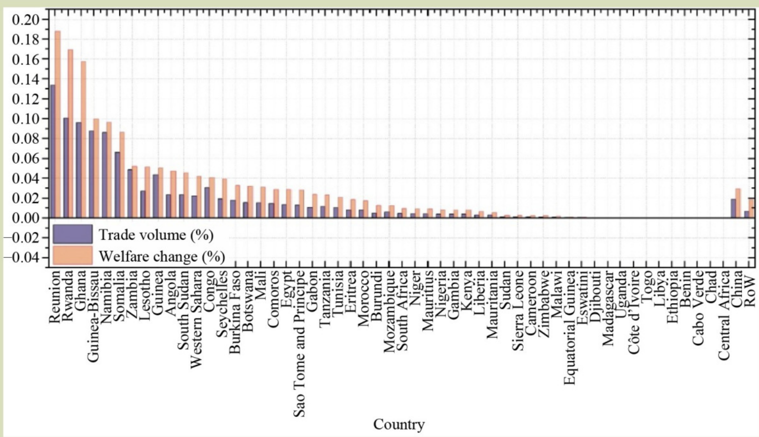
Correspondences: zhang_2q@163.com,
kofi.apreku@sinu.edu.sb

GRAPHICAL ABSTRACT



ABSTRACT

The COVID-19 pandemic and geopolitical tensions have introduced significant uncertainty into global value chains, posing challenges to food security in both African countries and China. Agricultural trade offers a solution to the mismatches between food supply and demand. This study used a structural multi-country general equilibrium trade model to assess the welfare impacts of agricultural trade between China and Africa. It examines key patterns in China–Africa agricultural trade, followed by a model framework and empirical analysis. The results indicate that African countries have yet to fully exploit their agricultural trade potential. Greater trade liberalization between China and Africa could substantially enhance welfare in African countries by increasing real incomes and improving household access to food. While a small number of African countries currently dominate exports to China, the removal of trade barriers and deeper agricultural cooperation could enable a broader range of countries to benefit over time.

1 Introduction

Major global crises have highlighted how movements of people, trade and data connect an increasingly interdependent world[1]. The COVID-19 pandemic and the Russia–Ukraine conflict have caused severe disruptions to global supply chains, leading to sharp increases in food prices and creating significant uncertainty for food supplies in Africa[2]. African countries that rely heavily on wheat imports from Ukraine and Russia, such as Egypt, Tunisia, Somalia, Kenya, Ethiopia and Sudan, have been particularly affected. These adverse shocks have intensified pressure on food security in these countries, leading to social unrest, violence and, in some cases, famine revolutions. According to a report by Welthungerhilfe[3], Africa's hunger index has worsened due to the compounded effects of the pandemic, climate change and conflicts disrupting agricultural production. Since the poor typically spend a larger portion of their income on food compared to wealthier households, these shocks have disproportionately trapped the most impoverished African countries in cycles of intergenerational poverty[4,5]. Additionally, worsening crop yields caused by droughts and climate change, along with short-term policy measures, such as export restrictions, and speculative activities in agricultural markets, have further aggravated the situation. For example, the Indian government abruptly banned wheat exports in May 2022, despite prior forecasts predicting that India could increase its wheat exports as the second-largest wheat exporter globally[6].

China's agricultural imports rely heavily on global markets, especially for key products including soybeans, maize and barley (used as feed). The Russia–Ukraine conflict has increased uncertainty in food supply chain[7]. China is experiencing a phase of consumption upgrade currently; consumers are demanding more high-quality products, such as coffee, cocoa and cashews. While Africa is a major source of these products and is known for their excellent quality, its premium agricultural products are rarely found in China, either in physical stores or online platforms. Considering that China and sub-Saharan Africa account for more than one-third of the global population, the success of the United Nations Sustainable Development Goals (SDGs) largely depends on the ability of these two populous regions can achieve food security and economic sustainability[8].

Our study builds on three key references. First, about the global food security mechanisms. In recent years, the definition of food security has expanded beyond simple food availability to include nutritional value and diversity[9]. The development of international food trade offers an opportunity to alleviate food security crises. As widely noted, trade tends to reduce the price gap between high and low ends, also global production prices are generally less volatile than within individual countries[10,11]. Bradford et al.[12] provided evidence showing that domestic production is far more volatile compared to global production for key staples like maize, rice, wheat and vegetable oils. However, there is limited research on the role of China–Africa trade cooperation in mitigating food security issues. This may be due to the fact that many policymakers overlook the benefits of free trade as explained by the Ricardian model of international exchange during periods of food price spikes, especially in countries with widespread poverty[10,13,14]. Instead, their initial response is typically to impose border restrictions to increase domestic supply[14,15]. India's recent ban on wheat exports serves as an example of this, although such measures are often suboptimal[16]. This gap motivated our examination of welfare dynamics as the critical link connecting trade and food security.

Second, the evolution of China–Africa agricultural trade cooperation. Early studies questioned the sustainability of China's agricultural assistance to Africa, they focusing on short-term price fluctuations while giving limited attention to the long-term institutional effects of cooperation[17]. However, emerging evidence indicates a shift from an aid-driven to a trade-oriented model of China–Africa cooperation, which has the potential to generate sustained welfare gains[18]. Additionally, policy coordination between the two sides has fostered innovation, as seen in e-commerce collaboration, which has reduced intermediary costs and increased export premiums for African farmers[19]. Greater policy alignment between countries also enhances resilience against external shocks, mitigating their negative impact on food security.

Multi-country general equilibrium models have been widely applied in agricultural trade analysis. Anderson and van Wincoop[20] made pioneering contributions by developing the first multi-country general equilibrium model incorporating trade costs, providing a microeconomic foundation for quantifying bilateral trade flows. Caliendo and Parro[21] extended this framework to agricultural trade, and their model has been extensively used for agricultural policy simulations, such as assessing the impact of US tariffs on Mexico's welfare. Subsequently, the Global Trade Analysis Project (GTAP) model further refined agricultural sector analysis by disaggregating it into 18 subsectors and incorporating land and water constraints, making it a mainstream tool for global food trade analysis[22]. However, multi-country general equilibrium models have limitations in the context of China–Africa agricultural trade. Specifically, they struggle to capture the bidirectional policy-trade feedback mechanism inherent in China–Africa cooperation. For example, China's preferential trade policies for African agricultural products are often accompanied by infrastructure assistance. To address this gap, we endogenized the China–Africa cooperation within the model, enabling a quantitative representation of geopolitical cooperation intensity with a limited set of parameters.

Our analysis departs from existing studies in several key aspects. The multi-country general equilibrium trade model extends prior research on the impact of China–Africa agricultural trade on food security. Recent studies highlight that policy coordination within the framework of South–South cooperation can significantly reduce trade uncertainty risks. Our analysis provides quantitative evidence for this mechanism. Rather than focusing solely on short-term trade and food supply shocks, we also examine the sustained impact of China–Africa cooperation on economic welfare, particularly through changes in real wages as a reflection of how agricultural trade improves welfare, showing that the increase in real income generated by agricultural trade indirectly enhances access to food. Compared to the GTAP model, our quantitative model relies on fewer parameters, offering a clearer view of the underlying mechanisms. Finally, we provide a detailed breakdown of welfare changes in each country, rather than presenting a simple good/bad overall trend.

Then we present key facts and trends in China–Africa agricultural trade structures from 2001 to 2022, and use a quantitative trade model to analyze the impacts of China–Africa trade cooperation on food security. In short, this model simulates the potential effects of the China–Africa Free Trade Agreement (FTA), depending on the degree of initial interdependence between the two regions. Lastly, we provide a detailed discussion of our conclusions, including the effects of other forms of agricultural cooperation such as aid and foreign direct investment between China and Africa.

2 Data sources and trend analysis

2.1 Data sources

We focus on the international trade and intersectoral trade between China and Africa. The data set includes China and 53 African countries. In addition, we constructed a category labeled "Rest of the World" in our general equilibrium model presented in Section 3, based on data availability and the scale of the countries involved. In our model, agricultural products are broadly classified into five major categories according to the sections of the harmonized system 6-digit codes from World Integrated Trade Solution[23]. Category I includes live animals and animal products (Chs 1–5); Category II comprises vegetable products (Chs 6–14); Category III covers animal or vegetable fats and oils (Ch 15); category IV includes foodstuffs, beverages and tobacco (Chs 16–24); and category V contains raw animal products, cotton and various agricultural products from other chapters. Data from 36 agricultural sectors are calculated separately, allowing us to examine the trade shares of each sector individually (see App. 1 for the complete list of the 36 agricultural sectors). Due to the disruption of global logistics caused by the COVID-19 pandemic, we tried to limit our data to the period before 2020, rather than using the most recent available years. All country and industry data were obtained from the UN Comtrade database (2001–2022)[24].

2.2 Dynamic structural transition

China–Africa agricultural trade had a dual pattern of divergence in both growth rate and trade structure from 2001 to 2020, revealing both an expansion in scale and untapped potential. Africa's total agricultural exports to China rose sharply from 59.0 million to 3.16 billion USD over the last two decades, with a compound annual growth rate (CAGR) of 21.3%. In contrast, Africa's global agricultural exports grew at a mere 1.5% annually over the same period, positioning China as the fastest-growing emerging market for African agricultural goods. However, despite this impressive growth rate, Africa's agricultural exports to China accounted for only 5.5% of its total exports to China in 2020, being far below the global average of 16.4%, this highlighting a persistent trade gap. This indicates that trade barriers remain a critical bottleneck preventing the full realization of Africa's export potential.

China's export structure to Africa has undergone a two-stage transformation from a single-product focus to a more diversified portfolio (Fig. 1). Between 2001 and 2010, grain exports dominated, reflecting Africa's rigid demand during periods of food shortages. From 2011 to 2020, processed products gained significant traction, with categories such as edible oils and dairy products rising to 48% of total exports, marking China's downstream expansion along the agricultural value chain.

Similarly, Africa's agricultural exports to China have undergone three distinct phases of structural evolution (Fig. 2). From 2001 to 2010, live animals and animal products accounted for over 40% of exports, illustrating an early-stage resource-driven trade pattern. Between 2011 and 2020, plant-based and processed agricultural products rapidly gained

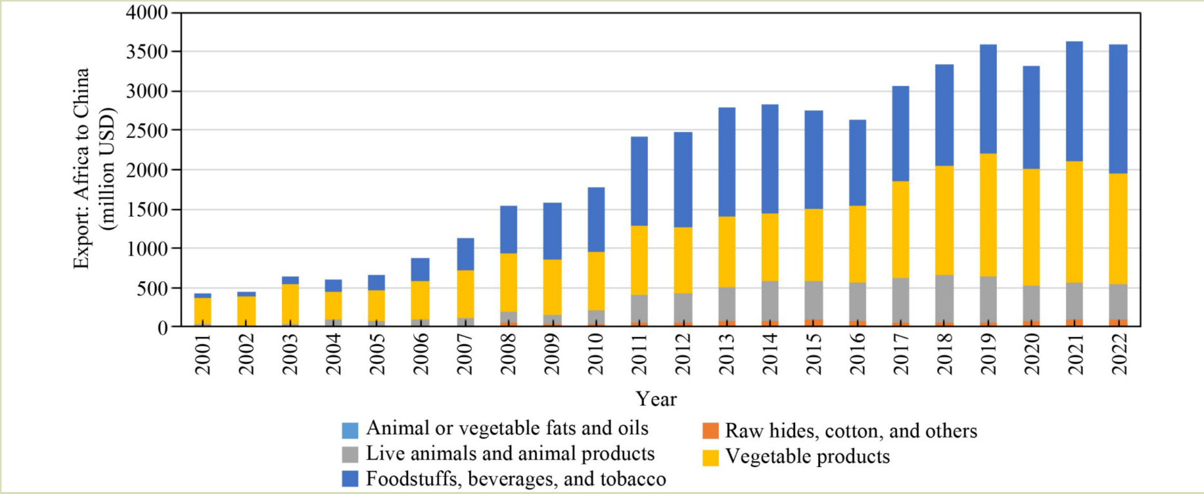


Fig. 1 Africa's agricultural exports to China, 2001–2022 (million USD).

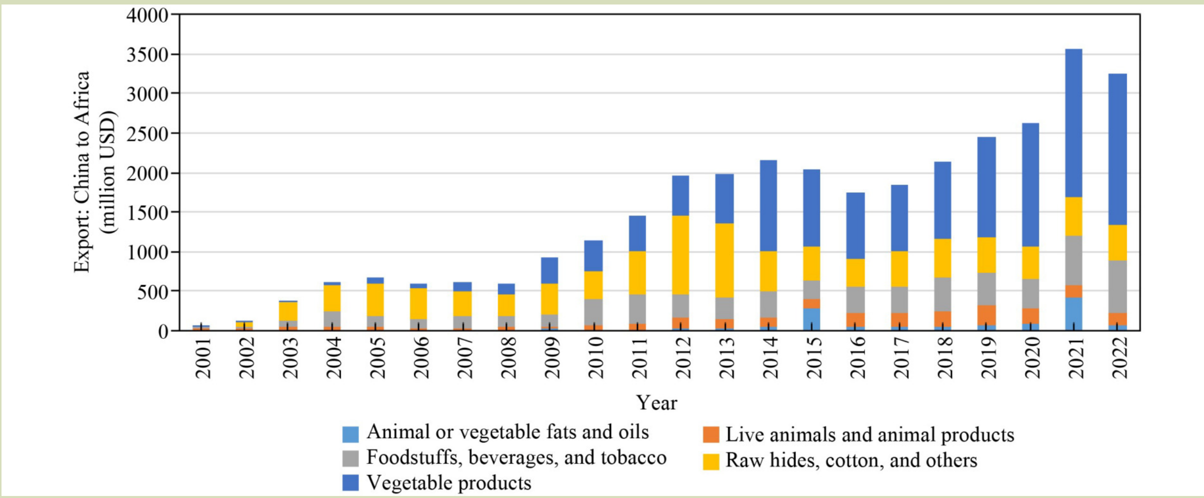


Fig. 2 China's agricultural exports to Africa, 2001–2022 (million USD).

prominence, collectively reaching 90% of total exports by 2020, signaling an upgrade in the industrial value chain. A new trend has emerged post-2020, with plant product exports surpassing 1.9 billion USD. Notably, 37.8% of Africa's oilseed and fruit exports are now destined for China, surpassing more established markets, including Europe, the USA and the Middle East. The rapid growth of animal feed and oilseeds (CAGR > 50%) and sugar and confectionery products (CAGR > 40%) reflects China's increasing demand for feed and processed food imports. However, Africa's strong export commodities, such as coffee and cocoa, account for less than 1% of its total exports to China, underscoring persistent challenges in brand development and distribution channels.

2.3 Trade geographic patterns

Significant country-level disparities exist in China–Africa agricultural trade, revealing patterns of trade concentration and the paradox of trade deficits. Ten African countries account for 80% of Africa's agricultural exports to China. Thirty-three African countries run trade deficits with China (Fig. 3). These deficits can largely be attributed to two key factors: internal supply-side bottlenecks in Africa and market access requirements in China. On the supply side, 28 of the 33 deficit countries are landlocked countries dominated by smallholder farming, and Africa's logistics costs are three to four times higher than the global average[25]. According to the World Bank Logistics Performance Index (2023)[26], the

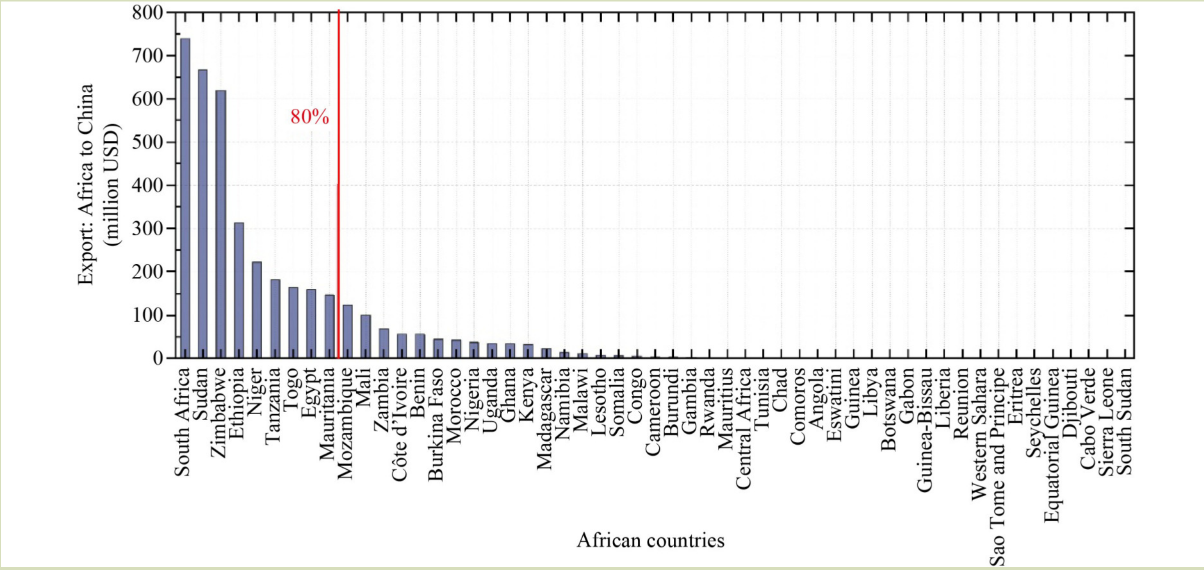


Fig. 3 Exports of agricultural products from African countries to China (million USD).

African countries with the best logistics performance strongly overlap with those that export the most agricultural products to China. On the demand side, China imposes strict sanitary and phytosanitary (SPS) requirements on African food imports. For example, as of 2023, only 12 African countries have obtained approval to export coffee and cocoa beans to China[27].

A similar pattern of trade concentration and scale is observed in China's agricultural exports to Africa. More than 70% of these exports are destined for nine African countries, including South Africa and Ghana. South Africa is China's largest agricultural export destination in Africa, accounting for 13.4% of total exports, followed by Ghana at about 10% (Fig. 4).

The trade balance structure reflects a positive coupling of resource endowments and policy incentives. Sixteen African

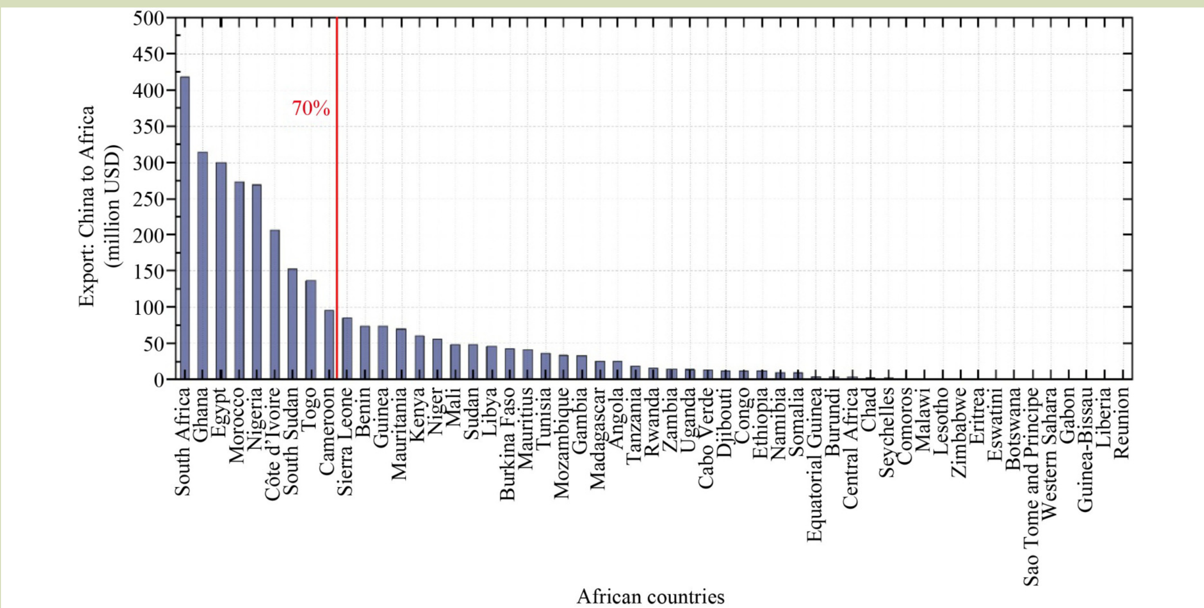


Fig. 4 Exports of agricultural products from China to African countries (million USD).

countries maintain a trade surplus with China in agricultural products, with the top three surplus countries increasing their combined share from 45% in 2001 to 72%, indicating a high degree of concentration. However, due to the heavy reliance of these countries on natural resources for agricultural production, critical ecosystems are undergoing degradation. In the absence of technological advancements, dependence on a single agricultural commodity leads to a low-base trap, where agricultural expansion exacerbates the resource curse. Four African countries maintain balanced agricultural trade with China, while the remaining 33 run deficits. These deficit countries have substantial untapped potential to export more agricultural products to China, given China's enormous demand for food imports (Fig. 5). In contrast, Africa's agricultural exports to China face high tariff barriers. According to WTO estimates (WITS, 2020)[23], tariff rates in Egypt, South Africa, Nigeria, the Democratic Republic of Congo and Mali stand at 10.0%, 7.9%, 16.79%, 9.92%, and 16.79%, respectively. Given these conditions, there is significant potential for enhanced trade cooperation between China and Africa.

3 Modeling framework

In this section, we use a multi-country general equilibrium trade model to predict the welfare impacts of agricultural trade between China and Africa. This model is based on the framework by Eaton and Kortum[28]. The economy consists of N countries and Each country can produce J types of goods, with a single factor of production (labor). In each country-product market (n, j), there is a continuum of perfectly competitive producers, and each good is produced using labor. Goods are traded between countries. Trade costs are significant and are modeled as iceberg costs. After defining the parameters of the economy, we solve for supply and demand and use market-clearing conditions to close the model.

3.1 Consumer problem

In each country n, a fixed number of consumers L_n maximize the following Cobb-Douglas utility function by consuming J types of goods:

$$U(C_n) = \prod_{j=1}^{J} C_n^{j\,\frac{1}{J}} \tag{1}$$

where, C_n^j is the consumption of good j in country n. Consumers distribute their spending equally across these goods, with expenditure shares summing to 1:

$$\sum_{j=1}^{J} \frac{1}{J} = 1 \tag{2}$$

Consumers earn income solely through their labor, supplying it inelastically. Each worker receives a wage w_n, giving total income in country n as:

$$Y_n = w_n L_n \tag{3}$$

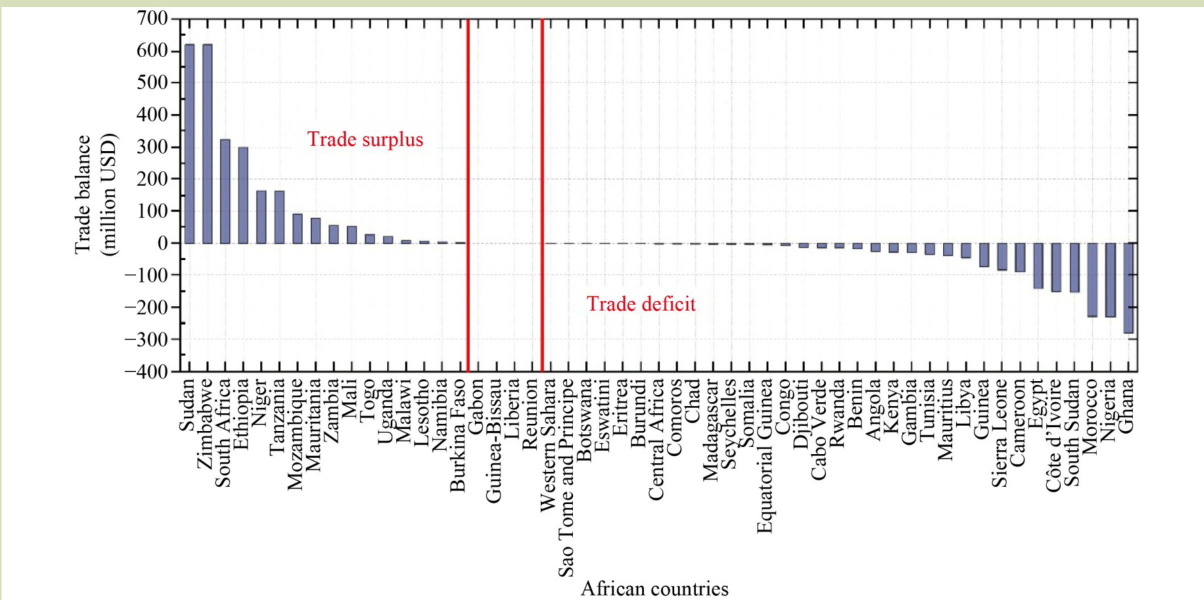


Fig. 5 Trade balance between African countries and China (million USD).

3.2 Production and trade

In each country-product market (i, j), firms can use need one unit of labor to produce $a_i(j)$ units of product j, which also measures the productivity for producing product j in country i. Under a perfect competitive market and the zero-profit condition, the price for good j produced in country i is:

$$p_i(j) = \frac{w_i}{a_i(j)} \tag{4}$$

In the process of international trade, transport inefficiencies may lead to losses. For each sector j, delivering one unit of a product from country i to country n, requires the shipment of d_{in} units $(d_{in} > 1)$, with $(d_{in} - 1)$ units lost in transit. In a perfectly competitive market without tariffs, the delivered price for each good j from country i to country n is:

$$p_{in}(j) = \frac{w_i d_{in}}{a_i(j)} \tag{5}$$

Following Eaton and Kortum[28], $a_i(j)$ is assumed to follow a Fréchet distribution $F_i(a) = \exp(-A_i a^{-\theta})$. The bilateral trade share from i to n can be expressed as:

$$\pi_{in} = \frac{A_i(d_{in}w_i)^{-\theta}}{\sum_{i=1}^{N} A_i(d_{in}w_i)^{-\theta}} \tag{6}$$

The trade share π_{in} indicates the proportion of country n's expenditure on goods from country i. Consequently, the trade value from countries i and n is given by multiplying Eqs. (6) and (3):

$$X_{in} = \pi_{in} Y_n = \frac{A_i(d_{in}w_i)^{-\theta}}{\sum_{i=1}^{N} A_i(d_{in}w_i)^{-\theta}} w_n L_n \tag{7}$$

In the global market, exports from each country should be absorbed by global demand, including exports and domestic consumption. Thus, the market equilibrium condition can be represented by:

$$Y_n = \sum_{i=1}^{N} X_{ni} \tag{8}$$

3.3 Market clearing

To complete the model construction, both goods and labor markets need to reach equilibrium, while maintaining trade balance:

$$Y_n = w_n L_n = \sum_{i=1}^{N} \left(\frac{A_n(d_{ni}w_n)^{-\theta}}{\sum_{n=1}^{N} A_n(d_{ni}w_n)^{-\theta}} w_i L_i \right) \tag{9}$$

In addition, we can define a price index P_i, so that:

$$X_{ni} = A_i(d_{ni}w_n)^{-\theta} P_i^{\theta} w_i L_i \tag{10}$$

We derive the real wage as:

$$\frac{w_n}{P_n} = \left(\frac{X_{nn}}{w_n L_n} \right)^{-\frac{1}{\theta}} A_n^{-\frac{1}{\theta}} \tag{11}$$

The real wages reflect the welfare level from trade liberalization. From Eq. (11), we can see that when domestic trade volume X_{nn} increases, in other words, when country n relies more on its own production and consumption rather than fully utilizing the benefits of international trade, it will ultimately lead to a decrease in the real wage $\frac{w_n}{P_n}$, which means that workers can buy fewer goods with the same wage. Real wage is an important indicator and often serves as a direct measure of welfare gain, because from one perspective, it reflects the actual income improvements that households experience. However, it also reflects the consumer purchasing power. This is particularly important in the context of food security, as purchasing power directly influences a household ability to acquire food and other essential goods. The relationship between real wages and food security is closed. Higher real wages enable consumers to purchase more food with the same amount of labor input. This increased capacity to buy food is fundamental to enhancing food security. So, we use it to represent the level of food security.

We include the "Rest of the World" in our model including non-African countries and China. We initially use elasticity estimates by Caliendo and Parro[21] to model the trade elasticity between Africa and China in agricultural products. Our baseline estimate is set at $\theta = 10.50$. Then we follow Eaton and Kortum[28] to calibrate other fundamentals by using the real data and adopt hat algebra to perform counterfactual analysis. We assume that the establishment of a free trade agreement between China and Africa will reduce the trade costs between the two regions. We next perform counterfactual analysis of free trade in agricultural products between Africa and non-African countries. The results are reported in Table 1 and Fig. 6.

Table 1 provides a detailed overview of the welfare changes and trade volume shifts resulting from the establishment of a FTA between China and Africa. Overall, the FTA has led to a reduction in trade costs, which has yielded positive welfare effects for both regions and enhanced food security in those countries. The decrease in trade barriers has facilitated increased trade volumes, thereby enhancing economic welfare through improved market access and more efficient resource allocation.

For China, the FTA has resulted in a notable increase in trade volume by 1.89% and a corresponding welfare change of 2.94%. This indicates that China has benefited from the FTA through

Table 1 Quantification of trade volume and welfare changes

Country	Trade volume (%)	Welfare change (%)	Country	Trade volume (%)	Welfare change (%)
Reunion	13.37	18.8	Niger	0.45	0.92
Rwanda	10.06	17.0	Mauritius	0.44	0.91
Ghana	9.59	15.7	Nigeria	0.40	0.82
Guinea-Bissau	8.75	9.98	Gambia	0.40	0.81
Namibia	8.61	9.63	Kenya	0.40	0.81
Somalia	6.61	8.63	Liberia	0.32	0.67
Zambia	4.89	5.19	Mauritania	0.31	0.58
Lesotho	2.73	5.15	Sudan	0.12	0.28
Guinea	4.37	5.05	Sierra Leone	0.14	0.28
Angola	2.36	4.74	Cameroon	0.12	0.27
South Sudan	2.36	4.55	Zimbabwe	0.11	0.26
Western Sahara	2.23	4.21	Malawi	0.09	0.18
Congo	3.06	4.08	Equatorial Guinea	0.06	0.10
Seychelles	1.94	3.92	Eswatini	0.06	0.09
Burkina Faso	1.79	3.28	Djibouti	0.02	0.03
Botswana	1.56	3.21	Madagascar	0.02	0.03
Mali	1.55	3.11	Uganda	0.01	0.02
Comoros	1.47	2.90	Côte d'Ivoire	0.01	0.02
Egypt	1.36	2.88	Togo	0.01	0.02
Sao Tome and Principe	1.31	2.83	Libya	0.01	0.02
Gabon	1.07	2.37	Ethiopia	0.00	0.01
Tanzania	1.17	2.32	Benin	0.00	0.00
Tunisia	1.05	2.09	Cabo Verde	0.00	0.00
Eritrea	0.83	1.87	Chad	0.00	0.00
Morocco	0.82	1.75	Central Africa	0.00	0.00
Burundi	0.52	1.28	China	1.89	2.94
Mozambique	0.60	1.27	the Rest of the World (RoW)	0.69	1.86
South Africa	0.46	0.97			

expanded export opportunities and increased access to African markets, which has contributed to economic growth and improved living standards.

On the African side, the impacts vary significantly among countries. For countries that have substantial trade volumes with China, the trade creation effects are particularly pronounced. Countries such as Reunion and Rwanda have experienced substantial welfare improvements of 18.8% and 17.0%, respectively, alongside significant increases in trade volume. These gains indicate that the FTA has been particularly beneficial for these countries by enhancing their trade competitiveness and fostering economic integration. However, the benefits are not uniformly distributed across all African countries. While some countries have seen moderate to significant welfare changes, others have experienced minimal impacts. For example, countries such as Central African Republic and Chad have reported no change in trade volume and negligible welfare effects, indicating that the FTA benefits may be contingent on various factors including the national economic structures, trade capacities and policy environments. Overall, the benefits of welfare and trade creation experienced by African countries are substantially greater for China, given the established strength of the economy China.

In summary, the FTA between China and African countries

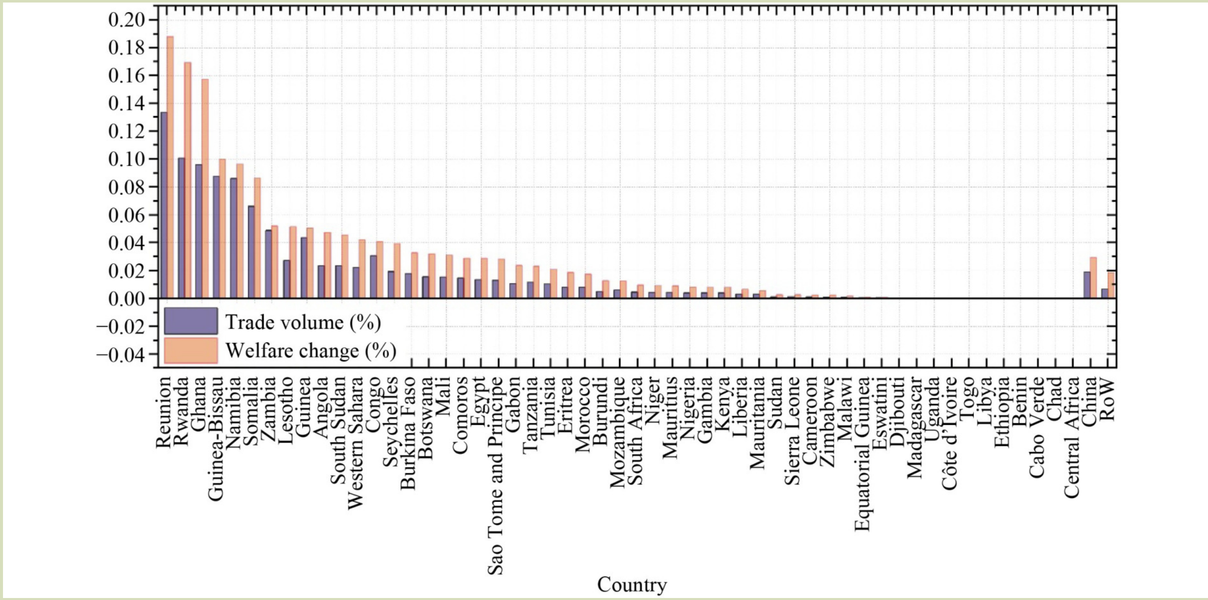


Fig. 6 Quantification of trade volume and welfare changes (%) in African countries and the rest of the world (RoW).

has generally led to positive outcomes by reducing trade costs and enhancing welfare. However, the magnitude of these benefits varies, highlighting the need for tailored strategies to maximize the potential gains from such agreements for all participating countries. This analysis underscores the importance of continued efforts to refine and implement policies that can further leverage the benefits of the FTA, ensuring that its positive effects are more evenly distributed and sustainable across the region.

4 Discussion

The findings of this study underscore the pivotal role of China–Africa agricultural trade liberalization in enhancing welfare and food security across both regions. Our structural multi-country general equilibrium modeling revealed that reducing trade barriers through initiatives like a China–Africa FTA generates significant welfare gains, particularly for African countries such as Reunion (18.8% welfare increase) and Rwanda (17.0%). These results align with emerging literature emphasizing the shift from aid-driven to trade-oriented cooperation[18] and corroborate the Ricardian principle that comparative advantages in agricultural trade can mitigate food price volatility.

The heterogeneous welfare impacts across African countries highlight structural and institutional disparities. High-performing exporters, such as South Africa and Ghana, benefit from preexisting logistics efficiency and policy alignment with China[26], while landlocked countries with fragmented supply chains (e.g., Chad, and Central African Republic) show minimal gains. This divergence underscores the critical role of infrastructure investment and capacity-building in unlocking trade potential. For example, reducing Africa's logistics costs, which are currently three to four times the global average[25], could amplify the FTA benefits. Similarly, harmonizing SPS standards and expanding market access for high-value products (e.g., coffee and cocoa) would address persistent export bottlenecks (GACC, 2023)[29].

China's welfare gains (2.94%) reflect its strategic diversification of food imports and downstream value chain expansion into processed goods. However, the relatively smaller impact compared to Africa indicates asymmetric interdependence, where China's larger economy absorbs shocks more efficiently. This asymmetry necessitates balanced policy coordination to ensure mutual sustainability. For example, integrating climate-resilient agricultural practices into trade agreements could mitigate ecosystem degradation in surplus countries, while China's technological investments in African agro-processing could reduce reliance on raw commodity exports.

Notably, the focus of our model on trade costs and real wages simplifies complex dynamics such as geopolitical risks and climate variability. While the Eaton-Kortum framework[28] effectively captures static welfare effects, it underestimates long-term feedback loops, such as how trade-driven income growth might spur agricultural innovation. Future research could incorporate dynamic elements, such as technology spillovers and adaptive capacity to climate shocks, to refine policy simulations.

5 Conclusions

This study quantifies the transformative potential of China–Africa agricultural trade liberalization in bolstering food security and economic welfare. By using a multi-country general equilibrium model, we demonstrate that reducing trade barriers significantly enhances real incomes, particularly in African countries, while diversifying China's import portfolio. Key findings reveal that welfare gains are highly contingent on infrastructure quality, policy alignment and product diversification, with top-performing countries achieving over 15% welfare improvements.

The practical implications are twofold. Policymakers should prioritize the establishment of a China–Africa FTA that integrates targeted infrastructure investments and capacity-building initiatives to maximize welfare gains and food security benefits. Specifically, they should focus on reducing Africa's disproportionately high logistics costs, currently three to four times the global average, by funding efficient transport networks and harmonizing SPS standards to boost market access for high-value agricultural exports like coffee and cocoa. Simultaneously, China should leverage its technological expertise to support African agro-processing industries, fostering value chain development and reducing reliance on raw commodity exports. To ensure long-term sustainability, the FTA should incorporate climate-resilient agricultural practices and address structural disparities, particularly in landlocked countries such as Chad and the Central African Republic, where trade benefits remain limited without enhanced connectivity and institutional alignment. While our analysis provides a robust baseline, further research is needed to integrate dynamic factors such as technological adoption and climate resilience. Ultimately, deepening China–Africa agricultural cooperation offers a viable pathway to achieving the UN SDG 2 (Zero Hunger), provided that equity and sustainability remain central to policy design.

Compliance with ethics guidelines

Zhendong Ma, Rui Wang, Faqin Lin, Qianqian Zhang, and Kofi Otumawu-Apreku declare that they have no conflicts of interest or financial conflicts to disclose. This article does not contain any studies with human or animal subjects performed by any of the authors.

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