Research Article

Price Transmission Effect of Establishing FTA with African Countries from the Perspective of Trade Facilitation

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The present article introduces the price transmission effect of establishing free trade areas with African countries from the perspective of trade facilitation. Studies on China-Africa economic cooperation, tariff reduction effects, trade facilitation effects, and price transmission effects in free trade areas were reviewed. The existing literature rarely incorporates tariffs, trade facilitation, and price transmission mechanisms into the research when studying the effects of free trade areas. The present article introduces trade facilitation into the research field of China-Africa cooperation. Taking the China-Mauritius free trade area as an example, the Global Trade Analysis Project model is used to study the price transmission effect after the establishment of the China-African free trade area. Create a model and motivation for other countries to establish free trade areas with African countries. The main conclusions are as follows: China-Mauritian free trade area has improved not only the terms of trade, GDP, and social welfare of the two countries, but also other African countries. This improvement effect mainly comes from the improvement of trade facilitation, and the contribution of zero tariff policy is relatively small. The domestic price changes in many industrial sectors of the two countries showed a significant increase, while the import prices generally showed a downward trend. Therefore, countries should actively participate in the process of global economic integration, and, in the negotiation of trade liberalization, both sides should adopt differentiated negotiation strategies and improve the weak aspects of trade facilitation, respectively, to achieve a win-win situation.

1. Introduction

China-Africa economic and trade cooperation has continued to deepen since the "Belt and Road" initiative (BRI) was put forward. In 2019, China-Africa trade volume reached US $208.7 billion. China has now become Africa's largest trading partner for 11 consecutive years. In order to explore the possibility of deepening economic and trade cooperation with African countries, China and the Republic of Mauritius "Mauritius" formally signed a free trade agreement in October 2019. The agreement covers many areas such as trade in goods, trade in services, investment, and economic cooperation and has achieved the goal of being "comprehensive, high level, and mutually beneficial." The agreement will be officially implemented on January 1, 2021. Its implementation will not only provide a stronger institutional guarantee for the deepening of Sino-Mauritian bilateral economic and trade relations, but also give China-Africa comprehensive strategic cooperative partnership a new form and content, promote the formation of a closer community of interests and a community of destiny between China and African countries, and better promote the “Belt and Road” initiative to connect with the process of African economic integration.

Scholars in the field of economics try to find paretooptimal state for economic subjects in various real-life scenarios through various optimization approaches, such as an interactive biobjective optimization in T-environment [1, 2], optimized economic order quantity model in neutrosophic environment [3]. The GTAP model is generally used to evaluate the economic effects of establishing a regional economic organization or signing a regional agreement in a
general equilibrium economy environment [4–8]. Most scholars focus on the tariff reduction effects brought about by regional economic organizations or agreements.

Previous research perspectives using the GTAP model mainly focused on the impact of tariffs and rarely involved trade facilitation; and the measurement of the level of trade facilitation was continuously improved on the basis of previous studies. In addition, in terms of model analysis, generally only the macroeconomic benefits and industrial effects are analyzed, and the internal price transmission effects are rarely explored.

The organization of rest of this article is as follows. Section 2 reviews the existing literature on China-Africa economic cooperation, economic effects of tariff cuts and trade facilitation, and price transmission effect of establishing FTA. Section 3 takes China and Mauritius as examples to present the situation analysis of the level of trade facilitation. Section 4 uses the GTAP model to analyze the price transmission effect of the establishment of China-Mauritius FTA. Section 5 puts forward reasonable suggestions from the perspective of FTA negotiation based on the research of this article. Section 6 presents the conclusions and the future scopes of research.

2. Related Literature Review

The existing research related to this field, contribution, and research gap are elaborately described in this section and an author contribution table (see Table 1). The following subsections are provided to illustrate the related research and gap in this direction. To further discuss the price transmission effect of establishing free trade markets with African countries from the perspective of trade facilitation, the following research history is very much essential.

2.1. New Exploration of China-Africa Economic Cooperation. Since the establishment of the forum on China-Africa Cooperation, the economic cooperation between China and Africa in various fields has grown substantially. Particularly, after the “Belt and Road” initiative was put forward, it has attracted widespread attention from scholars. We cannot ignore the BRI’s importance and consequence for Africa, in particular with respect to business and institutional drivers. Despite its major impact on international trade and investment, BRI does not belong to present-day categories of international pacts and treaties. China is trying a new development model that relies on massive investments in infrastructure, roads, ports, and railways at home and abroad to connect Europe, Asia, and Africa and accelerate the industrial development of all participating countries [24, 25]. There are great opportunities for African companies to improve their productivity and competitiveness through the “Belt and Road” initiative, especially small and medium-sized enterprises [26]. In the process of cooperation, disputes are inevitable. The diversified dispute resolution solution proposed by the scholar Wang Guiguo, especially the method of resolving disputes through complaint coordination, reflects the tradition of an oriental culture [27].

In recent years, Africa’s economy has achieved rapid growth, which is inseparable from China’s strong support for Africa in the fields of trade and investment [28]. In the field of China-Africa trade, the bilateral trade volume has increased significantly, China’s trade deficit with Africa is showing an increasing trend, and the trade commodity structure has been generally stable [29]. The agricultural product trade has shown an overall growth trend, but it faces prominent structural problems. The continued decline in the degree of complementarity in bilateral agricultural trade will significantly restrict the growth potential of Sino-African agricultural trade. Therefore, deeper exchanges and cooperation in production technology, equipment, and capabilities are needed [30, 31]. This is closely related to the remarkable results of China-Africa cooperation in various fields and the deepening of the integration of the African continent. However, China-Africa trade still has the problems of a single trade structure and insufficient development momentum [32]. In addition, the spatial spillover effect of negative factors such as cultural differences, institutional differences, corruption, and ethnic tensions must not be ignored, which has brought multilateral resistance to Sino-African trade [33, 34]. Unfortunately, no scholars have conducted an in-depth discussion on the cooperation of the China-Africa free trade area.

2.2. Economic Effects of Tariff Cuts. At present, no scholars have explored the economic effects of establishing a China-Africa free trade area, but there are abundant research results related to the economic effects of other free trade areas. Scholars usually use the global trade model (gtap) under the general equilibrium framework to simulate and analyze the economic effects of the elimination of import tariffs in bilateral or multilateral free trade agreements. Members participating in the FTA can obtain real GDP, welfare, imports and exports, additional income, etc. However, the actual GDP and welfare of the countries that did not participate may have negative effects. It will also have different impacts on different industries [7, 9–13, 15, 35].

2.3. Economic Effects of Improved Trade Facilitation. The Trade Facilitation Agreement (TFA), a successful negotiated outcome of the Doha Round, entered into force in 2017 as a separate agreement. TFA aims to make the logistics of international trade simpler and cheaper by disseminating the best practices in managing the movement of goods across borders [14]. But it rarely involves trade facilitation. In recent years, more and more regional trade agreements have included trade facilitation clauses. The scope, specificity, and depth of trade facilitation commitments in different free trade agreements are different, but they all include the main core areas [36]. Therefore, scholars extracted the main indicators from the core areas and established a trade facilitation indicator system. Wilson et al. evaluated the trade facilitation level of APEC members by constructing a trade facilitation indicator system [37]; Wang Zhongmei made a comparative study on the relevant trade facilitation evaluation reports issued by WTO, APEC, World Bank, and
Daniel et al. used the three trade facilitation indicators of infrastructure, system, and market efficiency to investigate the contribution of trade facilitation for improving social welfare in Africa. Neufeld (2016) elaborated on the positive impact of the adoption of the WTO Agreement on Trade Facilitation (TFA) on accelerating the global flow of goods across borders, simplifying procedures, and speeding up customs clearance. At the same time, scholars have examined the trade gains brought about by the improvement of trade facilitation from different angles, confirming that improving trade facilitation will improve export performance, increase trade flow, and promote economic growth.

Table 1: Contribution of the authors.

| No. | References |
|-----|------------|
| 1.  | [9]        |
| 2.  | [10]       |
| 3.  | [11]       |
| 4.  | [10]       |
| 5.  | [12]       |
| 6.  | [13]       |
| 7.  | [7]        |
| 8.  | [14]       |
| 9.  | [15]       |
| 10. | [16]       |
| 11. | [17]       |
| 12. | [5]        |
| 13. | [18]       |
| 14. | [19]       |
| 15. | [20]       |
| 16. | [21]       |
| 17. | [22]       |
| 18. | [23]       |
| 19. | [8]        |
| 20. | Present study |

The system for measuring the level of trade facilitation is becoming more and more complete, but few studies have incorporated trade facilitation into the GTAP model and often only unilaterally pay attention to the smoothness of infrastructure. Therefore, the positive impact of trade facilitation on economic and trade cooperation cannot be ignored in the study of the China-Mauritian free trade zone.

2.4. Price Transmission Effect of Establishing FTA. A few scholars have used the GTAP model to study price transmission. Studies have found that changing border measures such as import tariffs and export tariffs can reduce the
transmission of prices from the international market to the domestic market, but the sales prices of domestic producers will be lowered, which may intensify competition in the international market [40–42]. The GTAP model can be used to explore how trade policies such as trade frictions and trade cooperation affect the price of a certain market in a region. It can be analyzed from the perspectives of price changes caused by changes in domestic demand, price transmission of intermediate product costs, and price transmission of cross-border trade [8, 23].

Based on this, from the perspective of trade facilitation, this article takes the China-Mauritius free trade area as an example to study the price transmission effect of a country’s establishment of a free trade area with African countries. A comparison between previous studies and this study is shown in Table 1.

3. Situation Analysis of the Level of Trade Facilitation

3.1. Establishment of the Trade Facilitation Index System.

Since the entry into force of the Trade Facilitation Agreement (TFA) on February 22, 2017, WTO members have actively acceded to the Agreement and made efforts to enhance trade facilitation. In order to estimate the respective levels of trade facilitation of China and Mauritius from 2010 to 2019, this paper draws on the trade facilitation index system of Wilson et al. [37], focuses on four aspects of the port efficiency, customs environment, regulatory environment, and e-business usage and finance of the two countries, and combines relevant studies of domestic and foreign scholars. Establish a second-level indicator system (as shown in Figure 1).

Data source: the data for the secondary indicators are mainly derived from the Global Competitiveness Report (GCR). The data on customs clearance efficiency comes from the Global Enabling Trade Report (GETR); the data on the corruption index comes from Transparency International (TI).

To avoid the influence of different dimensions between the data, the data is standardized. The indicators in this article are all positive indicators applicable to the maximum value standardization method (just as in the study of Wilson et al. [37]), as shown in the following:

\[ Y_i = \frac{X_i}{X_{\text{max}}} \]  

\[ Z_i = \frac{\sum_{n=1}^{n} Y_i}{n} \]  

where \( X_i \) is the original data of index \( i \), \( X_{\text{max}} \) is the maximum value of index \( i \), and \( Y_i \) is the standardized data of index \( i \). Finally, the Trade Facilitation Indicator (TFI) is calculated by formula (2).

3.2. Measure the Level of Trade Facilitation in China and Mauritius, Respectively.

2010–2019 China and Mauritius respective secondary indicators of trade facilitation scores are shown in Table 2. From the average of the secondary indicators in the past ten years, except for P1 (highway infrastructure quality), P2 (railway infrastructure quality), C3 (customs clearance efficiency), R2 (burden of government supervision), and E1 (Internet users), the average scores of other secondary indicators in China are lower than those of Mauritius (especially the unconventional payment indicators in the customs environment, the international corruption index, and judicial independence in the regulatory environment have low scores). Tourism is the third largest foreign exchange earning industry in Mauritius, which has driven the development of the transportation industry. The transportation industry in Mauritius is dominated by road transportation and it has a highly modern port and airport. Its road and aviation infrastructure quality scores have reached 4.8 and 5.2, ranked among the top 50 in the world.

However, in recent years, Mauritius has neglected the management and maintenance of transportation infrastructure, which has led to a downward trend in the quality of various transportation infrastructures, especially the quality of port infrastructure (from 5.0 in 2014 to 4.2 in 2018). To solve this problem, the Mauritian government was mentioned in the “2018/19 Fiscal Year Budget” to increase the budget for the expansion of roads, ports, and airports. The effect is obvious, and the specific performance is that in 2019 the scores of all subindexes of the quality of Mauritius’s transportation infrastructure have risen significantly. At the same time, Mauritius has a low score for customs clearance efficiency. Although it has risen from 3.2 in 2014 to 3.8 in 2019, it is still far below the world average. In addition, as a country with the best business environment in Africa, Mauritius has a good overall evaluation of the customs environment and regulatory environment, which is reflected in the high scores of related secondary indicators.

The final result of the 2010–2019 China and Mauritius trade facilitation index is shown in Figure 2. The trade facilitation indexes of China and Mauritius are both slightly higher than 0.6 (Figure 2 and Table 2), which is “a general convenience level” [43] that means both parties have greater potential for improvement. From the vertical comparison in Figure 2, it is obvious that China’s trade facilitation level is generally lower than that of Mauritius. However, from the perspective of horizontal development trends, from 2010 to 2015, China’s trade facilitation level has changed from inconvenience to general convenience (0.5904, 0.5991, 0.5949, 0.6016, 0.6072, and 0.6055); the trend has shown as a slow increase while having small fluctuations.

Since China formally signed the WTO “Trade Facilitation Agreement” in 2015, with the gradual implementation of a series of measures to improve trade facilitation, such as improving the business environment and increasing the efficiency of customs clearance, the level of trade facilitation from 2015 to 2017 has shown a rapid rise (0.6055, 0.6209, and 0.6305), which was higher than Mauritius (0.6223) for the first time in 2017, but China’s trade facilitation level declined slightly from 2018 to 2019. The level of trade facilitation in Mauritius from 2010 to 2013 showed a downward trend and then an upward trend. After reaching a high level (0.6417) in 2013, it declined for four consecutive years, and its score fell to the bottom (0.6223) in 2017.
The composition of the trade facilitation level indicator system

Port efficiency (P)  E-business usage and Finance (E)  Customs environment (C)  Regulatory environment (R)  E-business usage and Finance (E)

- Highway infrastructure quality P1
- Railway infrastructure quality P2
- Port infrastructure quality P3
- Aviation infrastructure quality P4
- Irregular payment C1
- The prevalence of non-tariff barriers C2
- Burden of customs procedures C4
- Judicial independence R1
- Burden of government supervision R2
- Corruption Perception Index R4
- Transparency in government decisions R3
- Internet users E1
- Availability of financial services E2
- Company’s utilization of new technologies E4
- Availability of new technologies E3

Value Range

The Lowest Degree  1  7  The Highest Degree

Figure 1: The composition of the trade facilitation level indicator system. Note. Except for the value range of customs clearance efficiency of 1 to 5, the Corruption Perceptions Index (the higher the score, the cleaner the corruption), and the Internet users (the percentage of personal Internet use) that range from 0 to 100, the value range of other indicators is from 1 to 7, where 1 represents the extremely low degree and 7 represents the highest degree. But for irregular payment C1, 1 means “very common” and 7 means “never happened;” for the prevalence of non-tariff barriers C2, 1 means “extremely restrictive” and 7 means “completely unrestricted.”

Table 2: 2010–2019 China and Mauritius trade facilitation each secondary indicator score

| Year | P1 | P2 | P3 | P4 | C1 | C2 | C3 | C4 | R1 | R2 | R3 | R4 | E1 | E2 | E3 | E4 |
|------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| China |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 2010 | 4.3 | 4.3 | 4.3 | 4.4 | 4.1 | 4.6 | 4.5 | 4.5 | 4.0 | 4.0 | 4.8 | 35 | 28.5 | 4.6 | 4.4 | 4.9 |
| 2011 | 4.4 | 4.6 | 4.5 | 4.6 | 4.1 | 4.5 | 4.5 | 4.4 | 3.9 | 3.9 | 4.7 | 36 | 34.3 | 4.7 | 4.5 | 4.9 |
| 2012 | 4.4 | 4.5 | 4.4 | 4.6 | 4.0 | 4.2 | 4.6 | 4.2 | 3.9 | 4.2 | 4.5 | 39 | 38.3 | 4.6 | 4.4 | 4.7 |
| 2013 | 4.5 | 4.7 | 4.5 | 4.5 | 4.0 | 4.3 | 4.6 | 4.2 | 4.0 | 4.3 | 4.4 | 40 | 42.3 | 4.5 | 4.4 | 4.7 |
| 2014 | 4.6 | 4.8 | 4.7 | 4.0 | 4.5 | 4.5 | 4.3 | 4.0 | 4.1 | 4.5 | 36 | 45.8 | 4.5 | 4.3 | 4.7 |
| 2015 | 4.7 | 5.0 | 4.5 | 4.8 | 4.0 | 4.2 | 4.5 | 4.2 | 3.9 | 4.0 | 4.5 | 37 | 49.3 | 4.5 | 4.3 | 4.7 |
| 2016 | 4.8 | 5.1 | 4.6 | 4.8 | 4.3 | 4.3 | 4.6 | 4.4 | 4.2 | 4.1 | 4.6 | 40 | 50.3 | 4.3 | 4.5 | 4.6 |
| 2017 | 4.6 | 4.8 | 4.6 | 4.9 | 4.5 | 4.5 | 4.6 | 4.6 | 4.5 | 4.4 | 4.5 | 41 | 53.2 | 4.4 | 4.5 | 4.6 |
| 2018 | 4.6 | 4.5 | 4.6 | 4.5 | 4.5 | 4.5 | 4.6 | 4.4 | 4.5 | 4.4 | 4.5 | 39 | 53.2 | 4.4 | 4.5 | 4.6 |
| 2019 | 4.5 | 4.5 | 4.6 | 4.5 | 4.5 | 4.5 | 4.6 | 4.4 | 4.5 | 4.4 | 4.5 | 41 | 54.3 | 4.4 | 4.5 | 4.6 |
| Average | 4.6 | 4.7 | 4.5 | 4.7 | 4.2 | 4.4 | 4.6 | 4.4 | 4.1 | 4.2 | 4.6 | 38.4 | 45.0 | 4.5 | 4.4 | 4.7 |

| Mauritius |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 2010 | 4.1 | —  | 4.5 | 5.0 | 4.8 | 5.0 | 3.8 | 4.6 | 4.8 | 3.8 | 5.1 | 54 | 22.5 | 5.1 | 5.4 | 5.1 |
| 2011 | 4.1 | —  | 4.7 | 5.1 | 4.9 | 4.9 | 3.8 | 4.6 | 4.9 | 3.6 | 4.8 | 51 | 24.9 | 4.9 | 5.4 | 5.0 |
| 2012 | 4.3 | —  | 4.8 | 5.2 | 4.9 | 4.9 | 3.6 | 4.6 | 5.1 | 3.7 | 4.7 | 57 | 35.0 | 5.0 | 5.3 | 4.9 |
| 2013 | 4.5 | —  | 4.9 | 5.0 | 4.6 | 4.8 | 3.6 | 4.6 | 5.0 | 3.8 | 4.5 | 52 | 41.4 | 5.2 | 5.3 | 5.0 |
| 2014 | 4.8 | —  | 5.0 | 5.0 | 4.6 | 4.6 | 3.2 | 4.7 | 5.1 | 3.9 | 4.5 | 54 | 39.0 | 5.2 | 5.2 | 5.0 |
| 2015 | 4.8 | —  | 4.7 | 5.1 | 4.7 | 4.4 | 3.2 | 4.7 | 5.0 | 3.9 | 4.8 | 53 | 41.4 | 5.2 | 5.0 | 5.0 |
| 2016 | 4.7 | —  | 4.2 | 4.8 | 4.6 | 4.7 | 3.2 | 4.7 | 5.0 | 3.8 | 4.8 | 54 | 50.1 | 4.6 | 4.9 | 4.7 |
| 2017 | 4.5 | —  | 4.2 | 4.8 | 4.6 | 4.8 | 3.2 | 4.7 | 5.0 | 3.6 | 4.6 | 50 | 53.2 | 4.5 | 4.9 | 4.8 |
| 2018 | 4.5 | —  | 4.2 | 4.8 | 4.6 | 4.7 | 3.8 | 4.6 | 5.1 | 3.7 | 4.6 | 51 | 52.2 | 4.5 | 5.0 | 4.8 |
| 2019 | 4.7 | —  | 4.5 | 5.0 | 4.6 | 4.9 | 3.8 | 4.6 | 5.2 | 4.0 | 4.6 | 52 | 58.6 | 4.5 | 5.0 | 4.8 |
| Average | 4.5 | —  | 4.6 | 5.0 | 4.6 | 4.8 | 3.5 | 4.6 | 5.0 | 3.8 | 4.7 | 52.8 | 41.8 | 4.9 | 5.1 | 4.9 |
Subsequently, the Mauritian government actively adjusted the strategy of improving trade facilitation and adopted a series of measures, such as vigorously developing infrastructure construction, amending the investment facilitation bill, implementing license digitization, and improving the business environment. The level of trade facilitation in Mauritius has increased significantly, and the TFI index score has risen sharply in the past two years, until 2019 even reaching the highest level in the past ten years (0.6469).

Although the levels of trade facilitation between China and Mauritius are similar, the port efficiency, customs environment, regulatory environment, and the specific conditions of e-commerce and finance are quite different. Therefore, the two countries should pay attention to the indicators with low scores, respectively, and strengthen and improve them in a targeted manner. For example, China should pay more attention to improvements in government integrity, simplifying customs clearance procedures and increasing judicial independence, while Mauritius needs to improve customs clearance efficiency, pay attention to the maintenance of transportation infrastructure, and promote e-commerce. In short, it is necessary for China and Mauritius to learn from each other’s strengths, work together to enhance trade facilitation, and accelerate the realization of trade liberalization between the two sides.

4. Analysis on the Price Transmission Effect of the Establishment of China and Mauritius FTA

4.1. Model Selection and Data Processing. This paper adopts the GTAP model (Global Trade Analysis Project) under the framework of general equilibrium to analyze the price transmission effect of tariff reduction and trade facilitation improvement in the China-Mauritius free trade area. The database uses the newly released GTAP10.0 version in 2019 and contains data from 65 industry sectors in 141 countries (regions). According to the importance of China and Mauritius’s major trading partners and related economies, the 141 countries and regions in the GTAP model are grouped into 8 regions (see Table 3), while the industry sector was merged from the original 65 sectors into 22 sectors: cereals and crops (GrainsCrops), wool (wool), livestock and meat products (MeatLstk), fishery products (fish), basic extractive industries (Extraction), sugar (sgr), beverages and tobacco products (b_t), food processing (ProcFood), textiles and clothing (TextWapp), leather products (lea), wood products (lum), motor vehicles and spare parts (mvh), light industry (LightMnfc), rubber and plastic products (rpp), electronic equipment (ele), machinery and equipment (ome), metal products (metal), heavy industry (HeavyMnfc), public utilities (Util_Cons), transportation and communications (TransComm), financial services (ofi), and other service sectors (OthServices).

4.2. Simulation Program Setting. This article focuses on the price transmission effect after the establishment of the China-Africa free trade area. Therefore, the setting of the simulation plan will ignore the key protected industries and high-tariff industries of both parties and directly simplify the long-term effect. That is, after a period of time after China and Mauritius established a free trade area, both sides have achieved complete trade liberalization and implemented zero tariffs. In addition to examining the economic impact of tariff concessions, we must also consider the economic impact of trade facilitation. In the previous article, the level of trade facilitation between China and Mauritius has been calculated based on the trade facilitation level indicator system. However, there is no precise measurement mechanism for the level of trade facilitation in the standard GTAP model, so it is necessary to introduce the “level of trade facilitation” into the GTAP model. How to choose the shock variables of trade facilitation measures? Scholars usually learn from the unobservable implicit technical parameter $a_{ms}$ [44]. It is assumed that, after long-term construction and development of...
4.3. Analysis of Simulation Results. This part first analyzes the mechanism of the price transmission effect caused by the shock of tariffs and trade facilitation, then use RunGTAP to simulate the impact of two variables' shock, and analyze the simulation results of terms of trade (TOT), GDP, social welfare (YEV), domestic prices (PM), and import prices (PIM) of various sectors in the two countries.

### Table 3: Grouping of countries or regions.

| Number | Countries or regions                  | Country abbreviation | Definition                                                                 |
|--------|---------------------------------------|----------------------|---------------------------------------------------------------------------|
| 1      | Mauritius                             | mus                  | Republic of Mauritius                                                       |
| 2      | China                                 | chn                  | Mainland China (excluding Hong Kong, Macao, and Taiwan)                    |
| 3      | Madagascar                            | mdg                  | Madagascar                                                                 |
| 4      | South Africa                          | zaf                  | South Africa                                                               |
| 5      | India                                 | ind                  | India                                                                     |
| 6      | Middle East and North Africa          | MENA                 | Qatar, Bahrain, Islamic Republic of Iran, Israel, Jordan, Kuwait, Oman, Saudi Arabia, Turkey, United Arab Emirates, Egypt, Morocco, Tunisia, and other countries |
| 7      | Sub-Saharan Africa                    | SSA                  | Sub-Saharan Africa                                                         |
| 8      | Rest countries or regions of the world | ROW                  | Other countries and regions                                                 |

Trade facilitation, the level of trade facilitation between the two parties will increase by an average of 5%.

4.3.1. Effect of Price Transmission Mechanism Analysis.

(1) Tariff Cuts. As shown in Figure 3, after a producer produces a product, the first link to produce a price is the ex-factory price. The ex-factory price plus the production tax (to) is the market price. After market prices are added to the consumption taxes of different consumer groups, the domestic product prices faced by producers, domestic product prices faced by consumers, and domestic product prices faced by the government are generated. When the product is exported abroad, the market price plus export tax or export subsidy will produce FOB; when importing products from other countries, the FOB price of the other country plus the freight will produce the CIF price. The CIF plus the import tariff is the import price of the product. The import price is added to the consumption tax of different consumer groups; the import prices of the product that producers, consumers, and the government face, respectively, can be obtained.

Therefore, if tariffs change, the import prices faced by producers, consumers, and the government will change, which will affect their respective demand and will further affect the production of industries that use the product as an intermediate product, leading to changes in output, and further will affect domestic market prices. In this way, in the global trade model, changes in tariffs have a domino effect. In addition, the scale of national trade will also affect price changes. If the tax reduction country is a large country and its domestic prices fall, it will increase international demand and further increase international prices. The result of lower tariffs by major countries is that the volume of trade has increased, but the terms of trade have deteriorated. Obviously, the increase in trade volume has brought about the rise of national welfare, while the deterioration of the terms of trade has reduced the level of social welfare. Therefore, the welfare effect of tariff reduction by large countries depends on the net benefits of these two opposite effects. For a small country, when it adopts a tariff reduction policy, the volume of trade will increase, but the terms of trade are difficult to change. Therefore, if a small country reduces tariffs, its social welfare level will rise.

(2) Improved Trade Convenience. How does trade convenience, as an implicit cost that affects price changes, affect imports and exports? In the Structure of the Standard GTAP Model [44], the formula for determining the import demand of commodities is as follows:

\[
q_{xsi,s} = -\alpha_{m} s_{i,s} + q_{imi,s} - \sigma_{i} \left( p_{mis} - a_{msi,s} - p_{imi,s} \right)
\]  

where

\[
p_{imi,s} = \sum_{k} \theta_{iks} \left[ p_{msi,k,s} - a_{msi,k,s} \right]
\]

In formula (3), \(q_{xsi,s}\) represents \(s\) region’s import demand for goods \(i\) in region \(r\); \(a_{msi,s}\) represents the effective price change caused by the invisible trade cost of trade convenience; \(q_{imi,s}\) represents region’s total import demand for goods \(i\); \(\alpha_{m}\) represents import substitution elasticity of goods \(i\); \(p_{msi,s}\) represents \(s\) region’s import price of goods \(i\) imported from area \(r\); \(p_{imi,s}\) represents the average price of imported goods \(i\) in area \(s\). In formula (4), \(\theta_{iks}\) represents the share of the import volume of goods \(i\) imported from the \(k\) area in the \(s\) area to the total import volume of \(i\) goods in the \(s\) area. According to the above two formulas, it can be seen from the formula that the increase in \(a_{msi,s}\) leads to a decrease in the average import price \(p_{imi,s}\) and the decrease is smaller than the increase in \(a_{msi,s}\); which ultimately increases the demand for imports. In other words, the improvement of the level of trade facilitation promotes the increase of import demand.

(3) Contribution of Partial Effect of Tariff and Trade Facilitation. This article draws on the Decomposition Method proposed by Harrison [46] to calculate and analyze the contribution of the two shock variables of tariff and trade facilitation that produce the China-Mauritius FTA economic and trade effect. If all exogenous variables are assumed to be independent of each other, the change of any endogenous variable is exactly equal to the sum of the partial
effects of each exogenous variable on the corresponding policy shock, and the partial effects are obtained by the partial derivative method. The specific expression is

$$E(t) = F(X_i(t)),$$

where \( t \in [0, 1] \)

$$\Delta E = E_{t=0}^{t=1} \sum_{i=1}^{k} \varnothing_i, \quad \text{where} \quad \varnothing_i = \int_0^1 \frac{\partial F}{\partial X_i} dX_i dt$$

$$\rho = \frac{\varnothing_i}{\Delta E} = \varnothing_i \sum_{i=1}^{k} \varnothing_i, \quad \text{where} \quad i = 1, \ldots, k.$$  

\( E \) in the formula represents any endogenous variable in the general equilibrium model, which can be expressed as a function of the exogenous variable \( X \), and \( X \) is determined by the dummy variable \( t \) indicating whether the policy is implemented or not; \( \Delta E \) represents the change value of the endogenous variable caused by the exogenous shock, and \( \varnothing_i \) represents the partial effect of the exogenous variable \( X_i \); \( \rho \) represents the contribution of the exogenous variable \( X_i \) to the partial effect of the endogenous variable \( E \). The exogenous shock variables in this article are tariffs and trade facilitation. By incorporating each shock variable into the expression of \( \varnothing_i \) in formula (5), the partial effect of the corresponding variable can be obtained. And then, formula (5) can be used to further obtain the partial effect contribution degree of the corresponding variable.

4.3.2. Changes in terms of Trade, GDP, and Social Welfare. In general, the terms of trade (TOT) of China and Mauritius have improved significantly (China: 3.7805%; Mauritius: 3.3363%), while the terms of trade of other countries have slightly deteriorated (see Table 4). From the perspective of changes in GDP, all countries have improved. Mauritius has improved the most, and Madagascar, its important trading partner, has improved similarly. From the perspective of changes in social welfare (YEV), Mauritius has improved by 2.5598%, which is about twice of China (1.4718%). Other countries and regions, with the exception of India’s slight decline (but almost zero), have got different degrees of increase. Those changes are all driven by the promotion of trade facilitation. From the previous analysis, it can be seen that the direct cause of the change in terms of trade is the change in import prices and this change will promote changes in domestic demand and further affect changes in domestic market prices and domestic total output. The changes in linkage are ultimately reflected in changes of social welfare.

4.3.3. Changes in Domestic and Import Prices by Industry Sector. After the establishment of the China-Mauritius FTA, how will the domestic market prices and import prices of various industrial sectors in the two countries change? Obviously, China’s domestic prices have risen significantly. Among them, the domestic prices of fishery (fish) and service sectors (TransComm, ofi, and OthServices) have fluctuated more than 4%. The domestic prices of extractive industries (Extraction) have the smallest increase (1.2619%). The domestic prices of other industries have increased by 3%, while the import price dropped slightly, with a change of less than −1%. In Mauritius, the domestic price of wool products (wool) dropped slightly (−0.9405%), and the other industries all increased. The industries that increased by more than 4% included fishery (fish, 4.3269%), motor vehicles and spare parts (mvh, 4.2902%), electronic equipment industries (ele, 4.2641%), and machinery and equipment (ome, 4.4128%). Industries with an increase of less than 1% include leather products (leather, 0.5329%) and metal products (metal, 0.8404%); import prices have all declined to varying degrees, and sectors with significant declines include leather products (leather, −3.3513%), light industrial products (LightMnfct, −2.2142%), rubber and plastic products (rpp, −1.8387%), and electronic equipment (ele, −1.5088) (see Table 5 and Figure 4).
### Table 5: Changes in domestic and import prices of various sectors in China and Mauritius (%).

| Sector       | Domestic price | Import prices | Change of price | Domestic price | Import prices |
|--------------|----------------|---------------|-----------------|----------------|---------------|
| GrainsCrops  | 3.5415         | -0.5399       | 3.5796          | -0.6173        |
| wol          | 3.1079         | -0.6926       | 2.8124          | -0.9405        |
| MeatLstk     | 3.7845         | -0.6541       | 3.6273          | -0.6649        |
| fsh          | 4.3567         | -0.5515       | 4.3269          | -1.2732        |
| Extraction   | 1.2619         | -0.3844       | 2.8124          | -0.6694        |
| sgr          | 3.5313         | -0.6689       | 3.5517          | -0.532         |
| b_t          | 3.8078         | -0.7009       | 3.9314          | -0.418         |
| ProcFood     | 3.5985         | -0.6947       | 2.7605          | -0.5912        |
| TextWapp     | 3.5809         | -0.788        | 2.7874          | -0.3238        |
| lea          | 3.7271         | -0.7964       | 0.5329          | -0.7441        |
| lum          | 3.054          | -0.6754       | 1.9495          | -0.4371        |
| mnh          | 3.1348         | -0.7747       | 4.2902          | -0.5068        |
| LightMnfc    | 3.2875         | -0.7538       | 2.1345          | -0.3238        |
| rpp          | 3.4118         | -0.7228       | 4.584           | -0.4371        |
| ele          | 2.5989         | -0.9276       | 4.2641          | -0.4371        |
| ome          | 3.1827         | -0.7766       | 4.4128          | -0.4371        |
| Metal        | 2.7961         | -0.7124       | 0.8404          | -0.7441        |
| HeavyMnfc    | 2.7906         | -0.656        | 3.5722          | -1.1224        |
| Util_Cons    | 3.4326         | -0.7323       | 2.5196          | -0.9986        |
| TransComm    | 4.0922         | -0.7492       | 2.7765          | -1.0000        |
| ofi          | 4.4027         | -0.7411       | 3.9383          | -1.0000        |
| OthServices  | 4.1365         | -0.7543       | 4.3679          | -1.0000        |

Data source: this is compiled from RunGTAP simulation results.

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**Figure 4: Continued.**

![Graph of domestic and import prices](image)
5. Managerial Insights

Based on this, the following suggestions are proposed:

(1) Adopt differentiated negotiation strategies when conducting trade liberalization negotiations. Do a good preanalysis for the establishment of a sufficient FTA; identify the main beneficiary departments and main protection departments of the partner country as a bargaining chip for negotiations. In the case of China and Mauritius free trade area, Mauritius is bound to protect sensitive domestic sectors (such as wool, light industrial products, leather, and metal industry) appropriately, while China should use the sectors that benefit most from Mauritius as a bargaining chip to reduce the degree of protection of these sectors. On the contrary, when China negotiates with other countries to establish a free trade area, it should pay attention to its domestic sensitive departments (such as fisheries and extractive industries), adopting appropriate quotas, sensitive catalogs, or other nontariff barriers to protect them, so as to fight for its own interests while guaranteeing the interests of the other side.

(2) Capacity building, customs cooperation, and other trade facilitation provisions should be one of the priorities of future free trade area negotiations, because trade facilitation is the leading factor of the economic effect of the FTA. On the one hand, it is recommended to use the WTO’s Agreement on Trade Facilitation as a blueprint, implement flexible policies for some negotiating parties, and promote high-quality cooperation through capacity-building provisions. Provide assistance for capacity building in relatively backward countries, especially to strengthen education and infrastructure. On the other hand, abide by international laws and regulations and strengthen the terms of customs cooperation, including customs training, risk assessment and prevention, enforcement of customs valuation agreements, and electronic information exchange, simplifying customs procedures, improving compliance with laws and regulations, simplifying the procedures for entry and release of goods, and adopting internationally accepted documents and standards, etc.

(3) Take advantage of the implementation of the African Continental Free Trade Area Agreement to further explore the possibility of establishing FTAs with African countries. The example in the article proves that the price transmission effect of China and Mauritius FTA is significant, which greatly improves the terms of trade, GDP, and welfare of the two countries, provides a model for the negotiation of China-Africa free trade area, and also presents a model for other countries to establish FTAs with African countries. For China, it should participate in the process of global economic integration together with the African Continental Free Trade Zone to build a community with a shared future and achieve common development. The same is true for other countries.

6. Conclusions

In order to further discuss the price transmission effects of establishing a free trade zone with African countries, this article takes the China-Mauritius free trade zone as an example, measures the level of trade facilitation between the two countries, and finds out the advantages and disadvantages of the two countries, respectively. Then, we consider trade facilitation into the GTAP model and analyze the researched issues in depth from macroeconomic indicators and domestic and foreign market prices. The main conclusions are as follows:

(1) The China-Mauritius FTA not only improved the terms of trade, GDP, and social welfare between the two countries, but also improved the GDP and welfare levels of other African countries, especially
Madagascar. And this improvement effect mainly comes from the increase in the level of trade facilitation, and the contribution of the zero tariff policy is relatively small.

(2) The domestic prices of China’s fisheries and service sectors have risen significantly. The domestic prices of Mauritius’ fisheries, motor vehicles and spare parts, electronic equipment, mechanical equipment, and other sectors have risen significantly. The main reason may be that the per capita share of these sectors is relatively low. When per capita income increases, domestic market demand expands, thereby raising domestic market prices.

(3) The import prices of various sectors in the two countries have generally fallen, especially China’s electronic equipment, and Mauritius’s leather products, light industrial products, rubber and plastic products, and electronic equipment have dropped significantly. The main reason is that the two countries abolished import tariffs and increased the level of trade facilitation, which led to an increase in imports in these two sectors, and the increase in supply increased product competition, which in turn led to a decline in prices.

In reality, free trade zone negotiations between countries are a complex and huge project. It not only has negotiations on tariffs and trade facilitation, but also involves nontariff barriers such as technical trade barriers and sanitary and phytosanitary measures. All of these require more sophisticated techniques to be taken into account in the GTAP model in order to extend existing research. These are the limitations of this article.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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