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# Analysing the consequences of Regional Comprehensive Economic Partnership on the agricultural economies of China, Australia and New Zealand

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**Abstract:** The Regional Comprehensive Economic Partnership (RCEP) agreement is an important free trade agreement in the Asia Pacific region. The implementation of RCEP is greatly significant for ensuring the effective supply of agricultural products to member states. On the basis of the analysis of the agricultural product trade structure among China, Australia and New Zealand since 2000, we summarise in this article the potential consequences of tariff reduction for the agricultural products among the three countries under the RCEP framework. The Global Trade Analysis Project model has been used to analyse the effects of RCEP on the macroeconomic indicators, agricultural products trade and domestic agricultural output of the three countries. The research findings indicate that agricultural product trade among the three countries has grown rapidly since 2000. The results of the Global Trade Analysis Project simulations revealed that implementing RCEP will foster macroeconomic growth in the three countries. China's imports of beef and dairy products and wheat from Australia and New Zealand will substantially increase, and China's domestic production of this agricultural sector will decrease. Furthermore, India's potential participation in RCEP will further affect China's imports and exports of grain. These findings could guide the policymakers in the three countries in designing future agricultural production and trade strategies according to the different scenarios of international trade among the three countries and considering the potential of India joining.

**Keywords:** agricultural economy; Global Trade Analysis Project; international trade; tariff reduction

International trade agreements play an important role in the operation of international supply chains (Sheng and Jin 2022). In recent years, global economic growth has been hindered by geopolitical conflicts, climate change and the COVID-19 pandemic, leading to the imposition of high trade barriers (Wu et al. 2022; Fan et al. 2023). To establish a new higher level open economic system, elevate overall openness to the outside world and promote innovative trade development, China officially signed the Regional Comprehensive Economic Partnership (RCEP) on November 15, 2020 (China's Council State 2023). The agreement came into effect on January 1, 2022. Both Australia and New Zealand boast highly developed agricultural

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sectors, possessing exceptional agricultural resources and advanced production technologies (He and Sappideen 2013). As crucial agricultural product exporting countries among RCEP member states, they have also signed bilateral free trade agreements (FTAs) with China (He and Sappideen 2013). RCEP offers a fresh platform for the internationalisation and development of agriculture in China, Australia and New Zealand (CAN) and holds significant implications for global agricultural development. Particularly for China, a major agricultural producer and trader, RCEP will have substantial implications for achieving high-quality development in its agriculture during this new era (Wu et al. 2020; Khan and Ali 2022).

Despite the end of all negotiations regarding the terms of the agreement and market access with India in 2019, India announced its withdrawal from RCEP for several reasons. As India is an important global exporter of agricultural commodities such as rice, wheat and sugar, in the context of trade protectionism, the effect of India's accession to RCEP on the agricultural economy of CAN is important. It is of great practical significance for China to cope effectively with the turbulence of the international agricultural market and ensure the effective supply of important agricultural products. With the continuous progress of RCEP, more than 90% of agricultural products traded among CAN have achieved zero tariffs (Wu et al. 2022). This progress has led to a rapid expansion of agricultural trade among the parties. In 2022, the total agricultural trade volume between China and Australia reached a historical peak of USD 12.846 billion (Liu et al. 2023) and that between China and New Zealand reached USD 12.19 billion, marking year on year increases of 22.49% and 5.52%, respectively.

The 20$^{th}$ National Congress of the Communist Party of China further emphasised the need to enhance the strategy of developing free trade zones and construct a network of high-standard free trade zones that are open to the world. This emphasis underscores the importance of constructing high-quality free trade zones as a crucial path for China to open up further to the world (Vines 2016; Raghavan et al. 2023). Therefore, how significant will the effect of RCEP's implementation be on the agricultural economies of CAN? If India were to join RCEP, what effects would it have on the trade and production of the main agricultural sectors in China and India? Addressing these questions will provide an important factual basis for China to adjust its agricultural production and trade policies in a timely fashion.

Tariff barriers disrupt participation in international trade, but the FTAs and regional trade agreements such as RCEP aim to reduce or eliminate the tariffs to enhance the global value chain (Zainuddin et al. 2020; Badri Narayanan et al. 2023). After the implementation of RCEP, the academic community widely acknowledges that there is a consensus on the promotion of trade growth and social welfare among member countries through the elimination or reduction of tariff barriers (Liu and Zhao 2017; Chakraborty et al. 2019; Zhou et al. 2021; Park 2022; Xu et al. 2023). For instance, Li et al. (2017) and Wei et al. (2022) quantitatively examined the effect of RCEP on China's overall economy by using the Global Trade Analysis Project (GTAP) model, where they posited that the measures of trade liberalisation and facilitation under the RCEP framework contributed to the growth of China's social welfare, gross domestic product (GDP) and import-export trade. Although the foreign direct investment in China will increase because of the trade effect for different sectors, including agriculture, at the same time, the firms with the lowest productivity will be driven out because of the increased competition (Li et al. 2017).

In terms of RCEP's effect on China's agricultural economy, Liu and Zhao (2017) found that the implementation of RCEP would lead to a significant decrease in China's exports of wheat, sugar, cotton and dairy products, whereas exports of fruits, vegetables and aquatic products would increase slightly. Furthermore, in the current study, we expanded the analysis and assessed the potential effects of India's participation in RCEP on China's imports and exports of grain. Scholars have also compared the international competitiveness of agricultural products between China and Australia and between China and New Zealand (Long 2021; Zhou and Tong 2022; Graubner and Sexton 2023; Guo and You 2023). They discovered that within the primary RCEP member countries, New Zealand and Australia possess strong agricultural product competitiveness, whereas China's agricultural products exhibit only a marginal competitive advantage (Zhou and Tong 2022; Xu et al. 2023).

India decided to drop out from RCEP in November 2019; the cost and benefit of this decision depend on the 'volume of trade creation with respect to trade diversion' (Jain 2021). The potential effects of this decision have been addressed for some industrial sectors, but for the agricultural products they have not yet. For example, the recent literature revealed that, although imports of the Indian automobile industry would exceed exports, the net trade would gain from RCEP

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membership for both (finished automobile and intermediate auto parts sectors) (Badri Narayanan et al. 2023). Because of the backward and forward linkages in the global value chain, the different economic sectors in India will be negatively affected by withdrawal from RCEP, and India will face trade losses caused by higher import prices. This loss potential informs policymakers that rethinking joining RCEP or contemplating future trade agreements could support domestic productivity and be critical for improving Indian long-term export competitiveness (Jain 2021).

India has a comparative advantage in some final as well as intermediate goods and products with the majority of RCEP countries, which highlights the possibility of increased economic cooperation through a trade complementarity between India and other RCEP countries (Jain 2023). Therefore, India could think of rejoining RCEP to achieve the potential benefit for their economy and increase their share in the global value chain. Also, bilateral trade agreements between India and some RCEP countries such as South Korea, Thailand, Singapore, Malaysia and Japan were operational, and the trade between India and other RCEP countries would not have been different after India joined RCEP (Jain 2021). The effect of lower tariffs would have been evident for the remaining three countries (CAN). Moreover, there was fear of trade imbalance through a huge surge in imports of final manufactured goods from China and dairy product imports from Australia and New Zealand.

Because of the various agricultural strengths of each of the CAN countries, their agricultural product trade has a complementary nature, focussing on advantageous products like dairy, wool, beef and lamb from Australia and New Zealand (Si and Zhou 2007; Xu and Wu 2018). The effect of the China-Australia and China-New Zealand bilateral FTAs on China's dairy industry has been profound (Qi and Zhang 2018; Xu and Wu 2018). In addition, scholars have studied the economic effects of India joining RCEP, suggesting that India's inclusion would enhance overall social welfare, stimulate economic growth and mitigate its trade deficit to some extent (Chakraborty et al. 2019; Badri Narayanan et al. 2023). Nevertheless, there is scarce literature in which investigators examine the perspective of India's inclusion in RCEP regarding its effect on the macroeconomies and trade effects of CAN. In the present study, we use the GTAP model to simulate and analyse the trade and welfare effects of India's participation in RCEP's agricultural sector to address this issue.

The novelty of the current work could be highlighted in the following points. Firstly, we will predict the effects on agricultural production and trade among CAN countries from the perspective of India joining RCEP. Secondly, we analyse the tariff concessions of CAN agricultural products from the RCEP tariff concessions table. Finally, the GTAP model simulation has been used as a more accurate policy tool to predict and evaluate the gains from joining RCEP as a tariff reduction method for the agricultural sector (the main industry in the selected countries).

The structure of the article after this is as follows. The second section mainly includes methods and data sources (introducing the model framework and influencing mechanism of each variable of the GTAP model, meanwhile setting up simulation scenarios based on actual conditions). The third section mainly includes the results and discussion (introducing the scale evolution and structural changes in the agricultural trade among CAN countries since 2000, analysing characteristics of tariff reductions for agricultural products in the three countries under the RCEP framework and also analysing the effects of RCEP implementation and India joining RCEP on the agricultural economies of the three countries). The last section mainly includes the conclusion and policy recommendations according to the current findings.

## MATERIAL AND METHODS

The GTAP model was developed by Purdue University in the United States in 1993 (Corong et al. 2017). It is a type of computable general equilibrium (CGE) model and is widely used in economic and trade policies. It is a model used by international economic organisations such as the World Trade Organization, the World Bank, and the International Monetary Fund and is one of the very important policy analysis tools used when conducting research on the effects of trade.

The standard GTAP model offers several advantages. Firstly, it possesses a remarkable capability to flexibly and quantitatively assess the effects of international trade policies such as tariff reductions, trade subsidy measures and regional trade agreements. Moreover, it can effectively characterise and analyse the economic effects of these policies at both the country and industry levels. Secondly, the standard GTAP model is constructed on the traditional framework of general equilibrium analysis while using input-output tables from countries worldwide in its database, which enables it to evaluate the economic consequences of multisec-

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tor and multiproduct economies proficiently. Finally, the construction of the standard GTAP model is based on the basic framework of neoclassical economics. When the model is given a certain effect, the model makes the product market and the factor market reach an equilibrium state.

**GTAP model framework and simulation**

The GTAP model provides an effective policy simulation tool, so it has been widely used to analyse the international trade between countries or regions in the recent literature (Van Ha et al. 2017; Guo et al. 2022). The standard GTAP model mainly includes six major entities: the household sector, government sector, private sector, production sector, World Bank and other regions of the world (Walmsley et al. 2012). When the savings of a country or region enter global banks, the World Bank determines the flow of investment funds (Figure 1). Household and government sector consumption expenditures originate from, respectively, domestic producers and the rest of the world. Domestic producers engage in production activities by using original inputs and intermediate products. Intermediate products are sourced from domestic producers and imported from abroad. The products produced are divided into domestic and export sales (Pokrivčák et al. 2011).

The GTAP 10.0 database covers 141 countries and regions and 65 industry sectors (Aguiar et al. 2019). However, because the data in the GTAP 10.0 database extend only to 2014, we used the approach proposed by Walmsley et al. (2012). It treats growth rates of indicators like GDP, capital stock, skilled labour, unskilled labour and population as exogenous variables for shocks. This method allows for the extension and update of the database to align with the scenario simulation requirements, ultimately updating it to 2021, which enhances the realism of the model's simulation outcomes. We sourced the required data for dynamic recursions, such as GDP, population, capital and labour, from the GTAP at Purdue University. To facilitate model simulation and analysis, we categorised countries and industry sectors as follows: the 141 countries are grouped into China, Australia, New Zealand, Japan, South Korea, the United States, the 27 European Union member states, India, Association of Southeast Asian Nations (ASEAN) (Brunei Darussalam, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam) and other countries. The 65 industry sectors are divided into agricultural and nonagricultural sectors, further subcategorised into 20 agricultural subsectors and five nonagricultural subsectors [as shown in Table S1 in the Electronic Supplementary Material (ESM)].

***GTAP model framework.*** Under all assumptions, the GTAP model first assumes that the utility function of the household sector is the Cobb-Douglas production function, whose specific form is as follows:

$$U = C\,\Pi_{Ui} B_i \tag{1}$$

where: $U$ – utility of the household sector; $C$ – scale parameter; $U_i$ – utility of a single household; $B_i$ – distribution parameter of a single household.

Consumption in the household sector consists of three main behaviours: private expenditure, government expenditure and savings. The consumption behaviour of the private sector can be expressed by the constant difference of elasticity (CDE) function, denoted as follows:

$$G(z,u) = \sum_{i=1}^{N} B_i u^{b_i e_i} Z^{b_i} \tag{2}$$

where: $Z$ – standardised price; $u$ – utility function of the household sector; $b_i$ – elasticity of substitution; $e_i$ – expansion elasticity; $B_i$ – scale parameter.

The utility function of the government department under the condition of maximising utility is the Leontief production function. The production function of the domestic production sector is a nested constant elasticity of substitution (CES) function, the specific form is as follows:

$$Y = \alpha\left(\sum_{i=1}^{j} \delta_i x_i^{-\beta}\right)^{\frac{-1}{\beta}} \tag{3}$$

where: $Y$ – total output; $\alpha$ – efficiency elasticity; $\delta_i$ – allocation parameter of a single manufacturer's input; $x_i$ – output level of a single manufacturer.

Therefore, the household sector, private sector, government sector and domestic production sector together constitute the regional household sector in the GTAP structural process (Van Ha et al. 2017). There are two main economic behaviours in the household sector, private sector and government sector: consumption and saving. The goods consumed come from domestic manufacturers and manufacturers in other parts of the world. The income of the household sector, the private sector and the government sector is saved in the World Bank, and then the World

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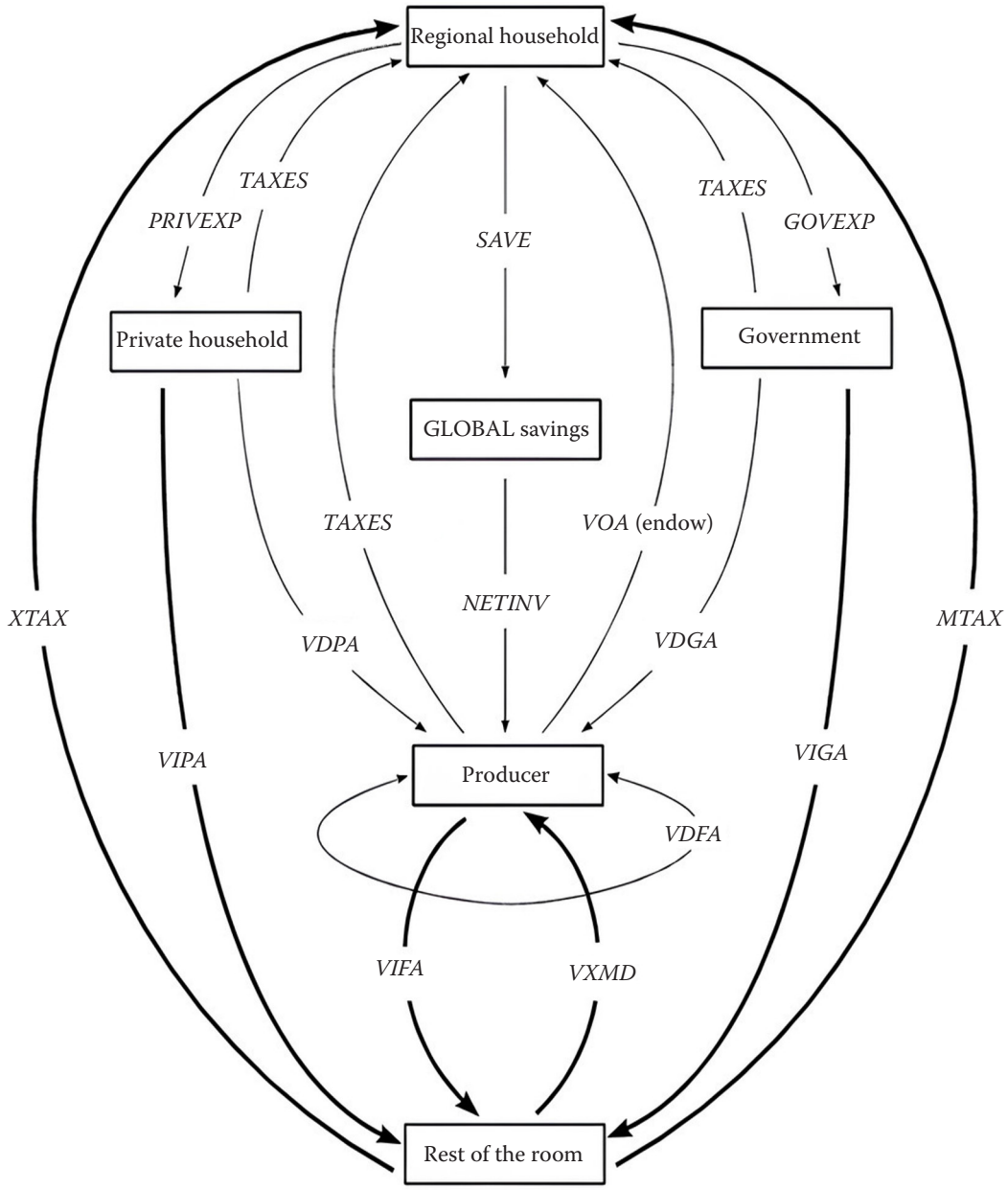


Figure 1. Graphical representation of a GTAP model

GTAP – Global Trade Analysis Project; *PRIVEXP* – private household expenditures; *GOVEXP* – government expenditures; *XTAX* – tax revenues; *VIPA* – value of domestic private household spend income on domestically produced and imported commodities; *VDPA* – value of domestic private household purchases, evaluated at agents' prices; *NETINV* – savings are completely exhausted on investment; *VDGA* – value of domestic private government purchases, evaluated at agents' prices; *VOA* – value of output at agents; *VIGA* – value of government spend income on domestically produced and imported commodities; *MTAX* – tax revenues; *VDFA* – value of domestic firm purchases, evaluated at agents' prices; *VIFA* – value of producers spend revenues on imported primary factors, evaluated at agents' prices; *VXMD* – value of firms get additional revenues for exporting commodities to the rest of the world.

Source: Brockmeier (2001)

Bank controls the flow of funds (i.e. investment) on a global scale.

From the perspective of production factors, the production sector mainly uses original production factors (there are five production factors in the GTAP model: land, capital, skilled labour, unskilled labour and natural resources) to produce goods and then sell some domestically and export to other parts of the world. For

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example, the agricultural sector uses these resources to produce the final agrifood products or secure raw materials for other related industries, and then these products are consumed locally or exported to other countries across the global value chain.

***Demand behaviour.*** The GTAP model assumes that the output level determines the consumption and savings of the country or region (Table S2 in the ESM), and its total utility function is the Cobb-Douglas function of household consumption expenditure, government consumption expenditure, and savings. Assuming that output meets the conditions of utility maximisation, according to the Cobb-Douglas utility function, this income will be allocated to household consumption expenditures, government consumption expenditures, and savings in fixed proportions. Any changes in the three will lead to changes in social welfare (Walmsley et al. 2012).

Because the model assumes in terms of household consumption expenditure, imported goods and domestic products cannot be perfect substitutes (Armington assumption). Therefore, the household sector's product preference is set as a CDE function, which is more general than the CES function. In addition, the GTAP model assumes that the utility function of the government department is in the Cobb-Douglas form to determine the government department's demand for different products. Therefore, the government department's expenditure on a certain product accounts for a fixed proportion of the total government expenditure (Walmsley et al. 2012).

***Producer behaviour, factor flow and trade market equilibrium.*** The GTAP model also assumes that production technology has constant returns to scale and that original inputs and intermediate inputs are separable. The output is the Leontief function of the original and intermediate inputs. The original and intermediate inputs are assumed to be irreplaceable, and these factors are combined into a total factor through functional equations (Pokrivčák et al. 2011; Uttama 2021; Park 2022). The intermediate input consists of two layers. The first layer is the combination of domestic products and total imported products, which is composed of a total intermediate input through the CES function. Total imports include imports from many sources, which are combined through the CES function. The volume of the imports is significantly affected by the tariffs between the countries that are trading, but the RCEP aims to reduce or remove these tariffs to increase the trade volume between the RCEP members.

The income of a country or region is a factor of income. The GTAP model assumes that income pursues utility maximisation through the Cobb-Douglas utility function and assumes that expenditures are allocated to household consumption expenditures, savings and government expenditures in fixed proportions. In equilibrium, national income equals the sum of household sector spending, government sector spending, and savings. Among them, household sector expenditure and government sector expenditure are reflected in the expenditure on domestic products and imported goods, respectively. Savings provide producers with investment funds through the World Bank. In equilibrium, the world's total savings are equal to the world's total investment. The products of producers in each region are used in domestic and international markets. A fixed proportion of the service sector's output is assumed to be exported to the virtual transport sector as international transport services (Walmsley et al. 2012). Therefore, in the model, enterprise output will be used domestically and internationally to provide transportation services. Products for the domestic product market encompass the needs of three different institutions: consumer demand by households, government demand and demand as intermediate inputs.

From the perspective of the trade market's equilibrium, international transportation services in the GTAP model are completed by a specific international transportation department, and the production of this international transportation department adopts the Cobb-Douglas production function. However, the lack of sufficient data linking export products to specific routes led to the aggregation of transportation services into a single composite internationally transported commodity. From the perspective of the export market, higher export prices help enhance the social welfare of a country or region, depending on the export destination market. In addition, different countries or regions export investment services to meet the demand for global savings, which will also become the terms of trade that affect the country or region. Subject to the CES equation, global traders will minimise the cost of purchasing services across sectors. In terms of international trade flows, the import amount of a certain product in a country or region is equal to the sum of the import amount of the product from different countries or regions (Corong et al. 2017) – that is, the total amount of a certain product exported by different countries or regions to the same country or region is equal to the total import of the product by the importing country or region so that the trade exchanges between countries or regions in the world are balanced.

***Macroeconomic closure.*** The CGE model performs policy simulation based on given relevant parameters,

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annual equilibrium price and quantity. Therefore, the relevant parameters of the CGE model are calculated by back calculating all model equations from the coefficients of the GTAP database and the external given elasticity. The process of solving the coefficients of the model parameters and coefficients is called 'model calibration'. The multiregional GTAP model adopts the neoclassical global closure rule and sets the elasticity by summarising the literature. The elasticities in the database are distinguished as follows: *i*) the substitution and output elasticity of the CDE minimum expenditure function, *ii*) the elasticity of products and imports in each region (Minton elasticity), *iii*) Armington elasticity among individual import sources, *iv*) substitution elasticity among original inputs, *v*) substitution elasticity among imperfect mobile factors and *vi*) expected net rate of return elasticity of capital stock.

In addition, because the GTAP model is calculated in the form of value, assuming the quantity remains unchanged, price is the most important intermediary in the simulation of the GTAP model and policy evaluation (Walmsley et al. 2012). For example, changes in tariff rates affect consumers in a country through prices, which in turn affects import volume, social welfare, production structure, imports and exports of other countries and so on. Moreover, in the GTAP model, nontariff barriers are simulated by tariff equivalents, and policy effects are also reflected through prices. Producer and consumer subsidies also affect prices through production taxes and indirect taxes. Therefore, price is the core and key to the policy simulation of the GTAP model (Walmsley et al. 2012); therefore, in this article, we try to analyse the consequences of FTAs, particularly the RCEP, on the agricultural economies of CAN by using the GTAP model.

***Scenario setup.*** The GTAP model is a multicountry, multisector general equilibrium model designed based on neoclassical economic theory (Walmsley et al. 2012). It serves as a vital method for quantifying the effects of trade policies through simulation. It has been widely used in trade policy analysis. Using the GTAP model for policy simulations makes it possible to investigate the effects of trade policies, including tariff reduction due to joining RCEP, on variables such as production, imports and exports, commodity prices, factor supply and demand, factor rewards, GDP and welfare levels in various industries and countries. Therefore, we used the GTAP methodology to simulate and analyse the trade effects of agricultural products among CAN countries after the implementation of RCEP with consideration of India's withdrawal.

Analysis using the GTAP model is divided into short-term closure analysis and long-term closure analysis (Francois and McDonald 1996; Walmsley et al. 2012). From the perspective of influencing mechanisms, on the one hand, short-term closure implies that the rate of return on capital and employment can freely vary while wages and capital stock remain fixed. Therefore, assuming the premise of being major economies, a substantial reduction in tariffs among the CAN countries in the short term will directly lead to lower export prices for Chinese products, weakening trade terms and an increase in labour and the labour force. However, because of the fixed capital in the short term, the growth in the labour force will contribute to the growth of GDP and an increase in social welfare in all three countries. On the other hand, long-term closure refers to fixed employment and the freedom for wages to vary, where the growth rate of capital stock equals the investment growth rate (Francois and McDonald 1996). Thus, in terms of long-term effects, the sustained decrease in labour force per unit of capital will lead to a real rate of return on capital higher than the steady-state rate of return, increasing the rate of return on capital, capital accumulation and capital-labour ratio growth. With a significant reduction in tariffs, trade conditions further improve, similar to the short-term effects, leading to economic growth and an increase in social welfare.

The RCEP negotiations, initiated in 2012, involved 8 years and 31 rounds of talks before finally coming into effect in 2022. From 2012 to 2019, India displayed a positive stance in the RCEP negotiations and made significant concessions on critical issues such as market access. These efforts contributed to the constructive progress of the RCEP negotiations. However, in a surprising turn of events in 2019, when all RCEP texts and market access negotiations were concluded, India announced its withdrawal from the agreement for various reasons. As of the current moment, although RCEP has already taken effect, member countries remain open to the possibility of India's re-entry into the RCEP FTA. Despite India's withdrawal in 2019, the stance of RCEP member countries remains receptive, indicating their willingness to consider India's participation in the agreement once again.

India's withdrawal from RCEP was influenced by various factors. Firstly, India believed that the provisions related to the services sector in the RCEP FTA were not sufficiently open. In contrast, the agreement seemed to prioritise the opening up of the manufacturing sector, raising concerns about potential adverse effects on India's domestic manufacturing industry (Shu

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et al. 2023). Secondly, from the perspective of tariff reduction commitments, RCEP required referencing the existing 'ASEAN+' FTAs (Daniel and Daniel 2020; Guo and Mai 2023). However, the existing 'ASEAN+' FTAs had different levels of liberalisation and openness compared with the RCEP agreement. Looking at the 15-year tariff reduction period, RCEP member countries aimed to achieve a liberalisation level of more than 85%. In contrast, India believed that it should maintain a liberalisation level of approximately 80% for countries with which it did not have existing FTAs (CAN), which contradicted the expectations of other RCEP members. Thirdly, as of 2022, India had signed FTAs with ASEAN, Japan, South Korea, and Australia, except for New Zealand and China. This situation led India to perceive that the economic effect of withdrawing from RCEP would be relatively limited, as it already had FTAs in place with major trading partners (Daniel and Daniel 2020; Guo and Mai 2023; Shu et al. 2023).

The current situation allows for India's potential reentry into the RCEP FTA, as member states remain open to this possibility and actively support India in its ongoing deliberations regarding joining RCEP. Also, after India withdrew from RCEP, it became a large economy with very unfavourable global trade terms, making its exports of many goods difficult. However, since 2021, the Modi government has launched several FTA negotiations and signed FTAs with the United Arab Emirates and Australia. In the fiscal year 2021–2022, India's total exports exceeded USD 400 billion, breaking the 'USD 300 billion spell' that has plagued India for more than a decade. Subsequently, the Modi government set a vision of USD 2 trillion in exports by 2030. The positive development of export trade has prompted the Modi government to attach greater importance to FTA negotiations. Therefore, it is possible for India to join RCEP in the future.

India is a significant exporter of staple agricultural products such as rice, wheat and sugar, so India's decision to join or withdraw from RCEP carries significant implications, especially in the context of prevailing trends of trade protectionism and unilateralism. Analysing the potential effects of India's participation in RCEP on the agricultural economies of CAN becomes crucial in effectively addressing the increasing volatility of the international agricultural market and ensuring the stable supply of essential agricultural products. Tariff elimination is expected to reduce India's export of vegetables, food, minerals and chemicals, plastic and plastic goods. Nevertheless, tariff reduction increases India's export of animal, leather, textile and wood products (Gobinda Goswami et al. 2023). Therefore, considering the effective implementation of RCEP and the potential for India's participation, we establish in this study a baseline scenario and four corresponding simulation scenarios based on the existing literature in this field.

Baseline scenario: A baseline scenario is necessary as a starting point for estimation using any CGE model. Immediate effects of RCEP implementation on the macroeconomic outcomes and major agricultural sectors of CAN.

Simulation scenario 1 (S1): Effects of RCEP implementation over a 10-year period on the macroeconomic outcomes and major agricultural sectors of CAN.

Simulation scenario 2 (S2): Effects of RCEP implementation over a 20-year period on the macroeconomic outcomes and major agricultural sectors of CAN.

Simulation scenario 3 (S3): Effects of RCEP implementation for 10 years followed by an 80% reduction in India's tariff on goods with RCEP member countries on the macroeconomic outcomes and major agricultural sectors of CAN.

Simulation scenario 4 (S4): Effects of RCEP implementation for 20 years followed by a 90% reduction in India's tariff on goods with RCEP member countries on the macroeconomic outcomes and major agricultural sectors of CAN.

## RESULTS AND DISCUSSION

The implementation of RCEP has a significant effect on the economic sectors of the RCEP members. For example, the agricultural sector in China will benefit significantly, whereas its effect on India is minimal. In the following section, firstly, we present the descriptive analysis result, including the current status of agricultural trade between the selected countries. Secondly, we present and discuss the results of the GTAP model.

### Descriptive analysis

***Current status of agricultural trade among CAN countries.***

– Agricultural trade scale among CAN countries. Since China acceded to the World Trade Organization, agricultural trade among the CAN countries has achieved remarkable development. In particular, the bilateral FTAs between China and Australia and between China and New Zealand, signed in 2015 and 2008, respectively, have significantly propelled the rapid growth of agricultural trade between these nations. The strong agricultural complementarity among the CAN countries has led to a substantial export market for Australian and

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New Zealand agricultural products because of China's increasing demand (Xu and Wu 2018) (Table 1).

Regarding China-Australia trade, before 2015, agricultural trade between China and Australia exhibited a rapid growth trend, increasing from USD 1.456 billion in 2000 to USD 9.026 billion in 2015, with an annual growth rate of 12.93%. In 2016, influenced by international market volatility, trade volume decreased slightly. However, with the enforcement of the China-Australia FTA, agricultural trade between the two nations stabilised and surpassed USD 10 billion from 2017 onwards (He and Sappideen 2013; Qi and Zhang 2018; Liu et al. 2023).

The implementation of RCEP in 2022 further boosted China-Australia agricultural trade to a historical peak of USD 12.846 billion, marking a year-on-year growth of 22.49%. In the case of China–New Zealand trade, agricultural trade exhibited slow development before 2008. However, with the enactment of the China-New Zealand FTA, agricultural trade between the two nations expanded rapidly (Lu et al. 2020; Fan et al. 2023). The bilateral agricultural trade volume increased from USD 2.314 billion in 2010 to USD 11.552 billion in 2021, with an average annual growth rate of 16.31%. In 2022, China-New Zealand agricultural trade also reached a historical high of USD 12.19 billion, reflecting a year-on-year growth of 5.52%.

– Product structure of agricultural trade among CAN countries. Investigators in existing studies adopt various classification methods for trading agricultural products. The classification method in this article is based primarily on the commodity classification system of the Harmonized Commodity Description and Coding System (HS) published by the World Customs Organization (WCO 2024). Agricultural products are categorised mainly within HS01 through HS24, along with additional agricultural products such as sorbitol (HS290543); alcohols and d-glucitol (HS290544); refined oils (HS3301); protein substances, modified starches and vegetable gums (HS3501~3505); polishing preparations (HS380910); dodecatrienoic acid (HS382360); raw hides and skins (HS4101~4103); raw fur skins (HS4301); silk (HS5001~5003); animal hair (HS5101~5103); raw cotton, waste cotton and combed cotton (HS5201~5203); raw flax (HS5301); and raw hemp (HS5302).

Australia and New Zealand have highly developed agriculture and animal husbandry industries, making them major exporters of bulk agricultural products such as meat, wool and dairy products, as well as cereal crops like wheat and barley. These agricultural products have distinct international competitive advantages. Although China's agricultural products, like tobacco, fruits, vegetables and processed foods, maintain a relatively stable trade position in both Australia and New Zealand, their export competitiveness on the global market is rather limited. As for the trade structure of agricultural products among the CAN countries, the main agricultural products imported by China from

Table 1. Agricultural trade scale between China, Australia and New Zealand (2000–2022) (in 100 million USD)

| Years | China–Australia total | Imports from Australia to China | Exports from China to Australia | China–New Zealand total | Imports from New Zealand to China | Exports from China to New Zealand |
|---|---|---|---|---|---|---|
| 2000 | 14.56 | 13.70 | 0.86 | 3.38 | 3.28 | 0.10 |
| 2005 | 26.83 | 24.06 | 2.77 | 7.52 | 7.05 | 0.47 |
| 2010 | 46.08 | 39.26 | 6.82 | 23.14 | 22.08 | 1.06 |
| 2015 | 90.26 | 80.61 | 9.66 | 46.09 | 44.27 | 1.83 |
| 2016 | 76.76 | 66.96 | 9.80 | 46.95 | 45.07 | 1.88 |
| 2017 | 100.01 | 89.99 | 10.03 | 62.13 | 60.18 | 1.95 |
| 2018 | 114.71 | 104.44 | 10.26 | 73.59 | 71.43 | 2.16 |
| 2019 | 121.65 | 111.33 | 10.31 | 91.11 | 88.92 | 2.19 |
| 2020 | 104.92 | 94.67 | 10.25 | 92.02 | 89.77 | 2.25 |
| 2021 | 104.87 | 93.85 | 11.01 | 115.52 | 113.13 | 2.39 |
| 2022 | 128.46 | 113.59 | 14.87 | 121.90 | 118.51 | 3.39 |
| Average (2015–2022) | 105.21 | 94.43 | 10.77 | 81.16 | 78.91 | 2.26 |

Total amount, exports and imports, all of which pertain to agricultural trade.
Source: General Administration of Customs of China database (2023)

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Australia were primarily cereals (HS10) edible meat offal (HS02) and other agricultural products; in 2022, the market shares were 25.13%, 21.17% and 19.19%, respectively. Looking at the HS six-digit codes shows that the highest market shares were for other wheat and mixed grains (HS100199); greasy wool, not carded or combed (HS510111); frozen boneless beef (HS020230); unspecified food preparations (HS210690); and frozen bone-in sheep meat (HS020442), with shares of 16.16%, 15.80%, 10.13%, 6.75% and 5.97%, respectively. However, China's exports of agricultural products to Australia in 2022 were mainly in HS24, HS20 and HS21, with market shares of 12.93%, 11.25% and 10.45%, respectively. In terms of HS 6-digit codes, the highest market shares were for other nicotine-containing non-combustible products (HS240412), unspecified food preparations (HS210690), sugar confectionery without cocoa (HS170490) and gluten (HS110900), with shares of 12.62%, 5.53%, 4.11%, and 3.42%, respectively.

Similarly, analysing the trade structure of agricultural products between China and New Zealand, the main agricultural products imported by China from New Zealand in 2022 are primarily in HS04, HS02 and HS19, with market shares of 43.47%, 22.56% and 11.87%, respectively. Looking at the HS six-digit codes shows that the highest market shares were for unsweetened solidified milk and cream (HS040221), retail-packaged food for infants and young children (HS190110), frozen boneless beef (HS020230) and frozen bone-in sheep meat (HS020442), with shares of 21.65%, 10.17%, 9.23% and 8.46%, respectively. Conversely, China's exports of agricultural products to New Zealand in 2022 were mainly in HS24, HS21 and HS03, with market shares of 20.59%, 12.90% and 8.03%, respectively. In terms of HS six-digit codes, the highest market shares were for other nicotine-containing products (HS240412), unspecified food preparations (HS210690), sugar confectionery without cocoa (HS170490), other plant juices and extracts (HS130219) and frozen unspecified vegetables (HS071080), with shares of 20.52%, 8.33%, 3.64%, 2.70% and 2.55%, respectively.

***CAN agricultural product trade tariff reduction under the framework of RCEP.*** The CAN agricultural product tariff reduction model is an important part of the negotiations under the framework of RCEP. Generally speaking, the tariff reduction model of FTAs is mainly divided into tariff reductions for general commodities and tariff reductions for sensitive agricultural products. Tariff concessions for general agricultural products are relatively large, which can generate more trade creation effects. Once the sensitive agricultural products are opened up, they will be vulnerable to shocks and have a negative effect on agricultural products and even other products. Therefore, the degree of protection is relatively high, and they will not be included in tariff reduction. Given the special status of agriculture, CAN agricultural products under the RCEP framework have a total of 960 HS six-digit tariff items, and there are four tariff treatment methods, which are immediate reduction to zero tariffs, phased (3 years, 7 years, 10 years, 15 years, 20 years) to zero tariffs, phased tax reductions (not zero) and sensitive agricultural products.

– Analysis of China's tariff reduction on Australian agricultural products under the RCEP framework. Under the RCEP framework, China's actual level of openness to Australian agricultural products is very high, with a tariff liberalisation rate of approximately 91.77%. Most of China's imports of agricultural products from Australia are in the category of tariff-reduction products. Among them, the number of tariff lines that immediately have a zero tariff is the highest, accounting for 58.54% of the total number of agricultural product tariff lines. The sections with the most tariff lines that immediately have a zero tariff are HS03, HS08, HS09, HS07, HS12 and HS16, ranking as the top six sections with 152, 29, 29, 66 and 39 tariff lines, respectively, which represent 27.05%, 5.16%, 5.16%, 11.74% and 6.94% of the total number of tariff lines with an immediate zero tariff. Regarding the phased tariff reduction, the number of agricultural product tariff lines that will become zero within 10 years and 20 years are 150 and 151, respectively, accounting for 15.63% and 15.73% of the total number of agricultural product tariff lines. The main sections participating in the tariff reduction include HS02, HS03, HS04, HS08 and HS20.

In terms of the reduction of tariffs on sensitive agricultural products, China has a total of 79 tariff lines for sensitive agricultural products imported from Australia, accounting for 8.23% of the total number of agricultural product tariff lines (Long 2021). Among them, fresh or chilled boneless beef (HS020130), frozen boneless beef (HS020230), unsweetened solidified milk and cream (HS040221), other durum wheat (HS100119) and other wheat and mixed wheat, excluding seeds (HS100199) are all categorised as sensitive agricultural products. These agricultural products are the main imports from Australia to China. In 2021, the import values of these agricultural products were USD 280 million, USD 785 million, USD 233 million, USD 460 million and USD 402 million, respectively, collectively accounting for 30.52% of China's total agricultural imports from Australia that year.

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– Analysis of China's tariff reduction on New Zealand agricultural products under the RCEP framework. Under the RCEP framework, China's tariff liberalisation level on New Zealand agricultural products is approximately 90.73%, slightly lower than that of Australia. Among these, the number of tariff lines that are immediately reduced to zero is the highest, totalling 576, which accounts for 60% of the total number of agricultural product tariff lines (Francois and McDonald 1996). The top five sections in terms of tariff lines immediately reduced to zero are HS03, HS07, HS16, HS01 and HS08. They have 152, 66, 39, 34 and 33 tariff lines respectively, making up 26.39%, 11.46%, 6.77%, 5.90% and 5.73% of the total tariff lines immediately reduced to zero. Looking at the phased tariff reduction shows that 135 tariff lines will be reduced to zero over 10 years and 160 tariff lines over 20 years. These account for 14.06% and 16.67% of the total agricultural product tariff lines, respectively. The main sections participating in the phased tariff reduction are HS02, HS03, HS04, HS08 and HS20 (Table 2).

Table 2. Chinese sensitivity of agricultural products to Australia and New Zealand under the RCEP framework

| Sensitive agricultural products set by China | |
|---|---|
| From Australia | From New Zealand |
| 020110; 020120; 020130; 020210; 020220; 020230; 040221; 040229; 090121; 090412; 100111; 100119; 100191; 100199; 100510; 100590; 100610; 100620; 100630; 100640; 110100; 110220; 110290; 110311; 110313; 110319; 110320; 110423; 120190; 120510; 120590; 150710; 150790; 150810; 150890; 150910; 150990; 151000; 151110; 151190; 151211; 151219; 151221; 151229; 151321; 151329; 151419; 151411; 151499; 151491; 151519; 151521; 151529; 151511; 151790; 151800; 170112; 170113; 170114; 170191; 170199; 240110; 240120; 240130; 240210; 240220; 240290; 240311; 240319; 240391; 240399; 510111; 510119; 510121; 510129; 510130; 510310; 520100; 520300 | 090121; 090412; 100111; 100119; 100191; 100199; 100510; 100590; 100610; 100620; 100630; 100640; 110100; 110220; 110290; 110311; 110313; 110319; 110320; 110423; 120190; 120510; 120590; 150710; 150790; 150810; 150890; 150910; 150990; 151000; 151110; 151190; 151211; 151219; 151221; 151229; 151321; 151329; 151419; 151411; 151499; 151491; 151519; 151521; 151529; 151511; 151790; 151800; 170112; 170113; 170114; 170191; 170199; 240110; 240120; 240130; 240210; 240220; 240290; 240311; 240319; 240391; 240399; 510111; 510119; 510121; 510129; 510130; 510310; 520100; 520300 |

RCEP – Regional Comprehensive Economic Partnership
Source: Ministry of Commerce of China (2023)

From the perspective of tariff reduction on sensitive agricultural products, China has a total of 71 tariff lines for sensitive agricultural products imported from New Zealand, accounting for 7.40% of the total number of agricultural product tariff lines. However, unlike sensitive agricultural products imported from Australia, sensitive agricultural products from New Zealand are not the main traded agricultural products between China and New Zealand (Xu and Wu 2018). Some agricultural products from sections such as HS10, HS11 and HS15 are included in the sensitive agricultural products category and are not subject to tariff reduction.

– Analysis of Australia's tariff reduction on Chinese agricultural products under the RCEP framework. Australia's level of openness to agricultural products from China is extremely high, with a tariff liberalisation rate of 99.58%. Most of Australia's imports of agricultural products from China are subject to immediate tariff reduction to zero. Among these, the highest number of tariff lines are immediately reduced to zero, totalling 901, which constitutes 93.85% of the total agricultural product tariff lines. Looking at staged tariff reduction shows that there are fewer agricultural product tariff lines reduced to zero over 3 years, 7 years, 15 years and 20 years, totalling 13, 32, six and four tariff lines, respectively, accounting for a small proportion of the total agricultural product tariff lines, which is 5.73%. The main agricultural product sections participating in staged tariff reduction are HS17, HS20 and HS22.

In terms of tariff reduction for sensitive agricultural products, Australia has a very limited number of sensitive tariff lines from China, totalling only four. These tariff lines include raisins (HS080620), homogenised vegetables (HS200510), unmixed citrus fruit juices (HS200931) and other unmixed citrus fruit juices (HS200939). Moreover, these four agricultural products are not the main agricultural products that China exports to Australia.

– Analysis of New Zealand's tariff reduction on Chinese agricultural products under the RCEP framework. New Zealand exhibits a high level of openness to agricultural products from China, with a tariff liberalisation rate of 95.42%. Most of New Zealand's imports of agricultural products from China are subject to immediate tariff reduction to zero. The highest number of tariff lines immediately reduced to zero is 768, constituting 80.00% of the total agricultural product tariff lines. Among these, sections HS03, HS08, HS07, HS02 and HS12 are the top five sections with the highest number of tariff lines immediately reduced to zero, com-

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prising 182, 62, 63, 42 and 46 tariff lines, respectively, accounting for 23.70%, 8.07%, 8.20%, 5.47% and 5.99% of the immediately reduced to zero categories. Looking at staged tariff reduction shows that there are 86 and 62 agricultural product tariff lines reduced to zero over 10 years and 20 years, respectively, accounting for 8.96% and 6.46% of the total agricultural product tariff lines. The main agricultural product sections participating in staged tariff reduction include HS02, HS16, HS20 and others.

Regarding the tariff reduction for sensitive agricultural products, New Zealand has identified 25 tariff lines for sensitive agricultural products from China, accounting for 2.60% of the total agricultural product tariff lines. Among these, certain agricultural products from sections such as frozen crabs (HS030614), dried onions (HS071220), fine flour of wheat or mixed grains (HS110100), cereal grains (HS110320) and products of vegetables, fruits, nuts, or other plant parts (HS20) are categorised as sensitive agricultural products. However, these sensitive agricultural products are not the main agricultural products that China exports to New Zealand (Table 3).

**Results of simulation**

***Effect on microeconomics of China, Australia, New Zealand and India.*** The signing of an FTA implies the reduction of both tariff and nontariff barriers, which initially leads to lower import and export prices for goods, thereby increasing export supply and import demand. Furthermore, the reduction in trade barriers can stimulate domestic production within member countries, leading to an increase in labour prices while the total labour supply remains constant. This dynamic, in turn, leads to higher household income, improved social welfare and overall economic growth. In addition, the trade effect Viner (2014) proposed suggests that an FTA promotes welfare growth for member countries within the trade area while generating trade diversion effects for countries outside the trade area.

Table 3. Australia and New Zealand sensitivity of agricultural products to China under the RCEP framework

| Sensitive agricultural products set to China | |
|---|---|
| From Australia | From New Zealand |
| 080620; 200510; 200931; 200939 | 030614; 071220; 110100; 110320; 110510; 110520; 151790; 170290; 190430; 200110; 200600; 200799; 200710; 200899; 200939; 200911; 200961; 200979; 200919; 210690; 230990; 240311; 240399; 330190; 350220 |

RCEP – Regional Comprehensive Economic Partnership
Source: Ministry of Commerce of China (2023)

Implementation of RCEP will promote macroeconomic growth in China, Australia and New Zealand, while leading to a decrease in welfare levels for India. The longer the duration of RCEP's implementation, the more pronounced the trade effects become. The likely reason is the strong trade-diversion effect of lower global prices driven by the general elimination of tariffs. With lower tariff rates, trade liberalisation tends to reduce the cost of goods in partner countries, stimulating demand for those goods. As destination demand increases, producers in exporting countries are likely to ramp up production. To meet this increased production, a greater quantity of intermediate goods, labour, capital and other essential factors are required. This resulting demand for production inputs leads to an increase in corresponding prices, wage rates and rental rates in competitive markets. Consequently, social welfare, imports and exports, as well as incomes between partner countries are enhanced. In addition, the welfare effect is used as a metric to gauge the alteration in the aggregate income in society. After the establishment of free trade zones, economies with elevated labour productivity and reduced commodity prices experience greater relative advantages, thereby fostering an augmentation in residents' welfare and economic earnings. The result shows that over a 20-year period of RCEP implementation, China's GDP, total imports, total exports, household income and social welfare will increase by 0.06%, 0.24%, 0.14%, 0.16% and USD 4 264.85 million, respectively (Figure 2 and Table S3 in the ESM).

These values are all significantly higher than the welfare effects observed after 10 years of RCEP implementation. Similar trends are observed in Australia and New Zealand. Regarding India's potential accession, irrespective of whether India joins after 10 or 20 years of RCEP implementation, there will be a substantial promotion of macroeconomic growth in both India and China. Among these scenarios, the greatest welfare promotion effect is observed for China, particularly if India joins RCEP after 20 years. In this case, China's GDP, total imports, total exports, household income and social welfare will increase by 0.21%, 0.48%, 0.35%, 0.22% and USD 11,126.45 million, respectively, which are significantly higher than in other scenarios. Australia and New Zealand also experience varying degrees of growth under these conditions.

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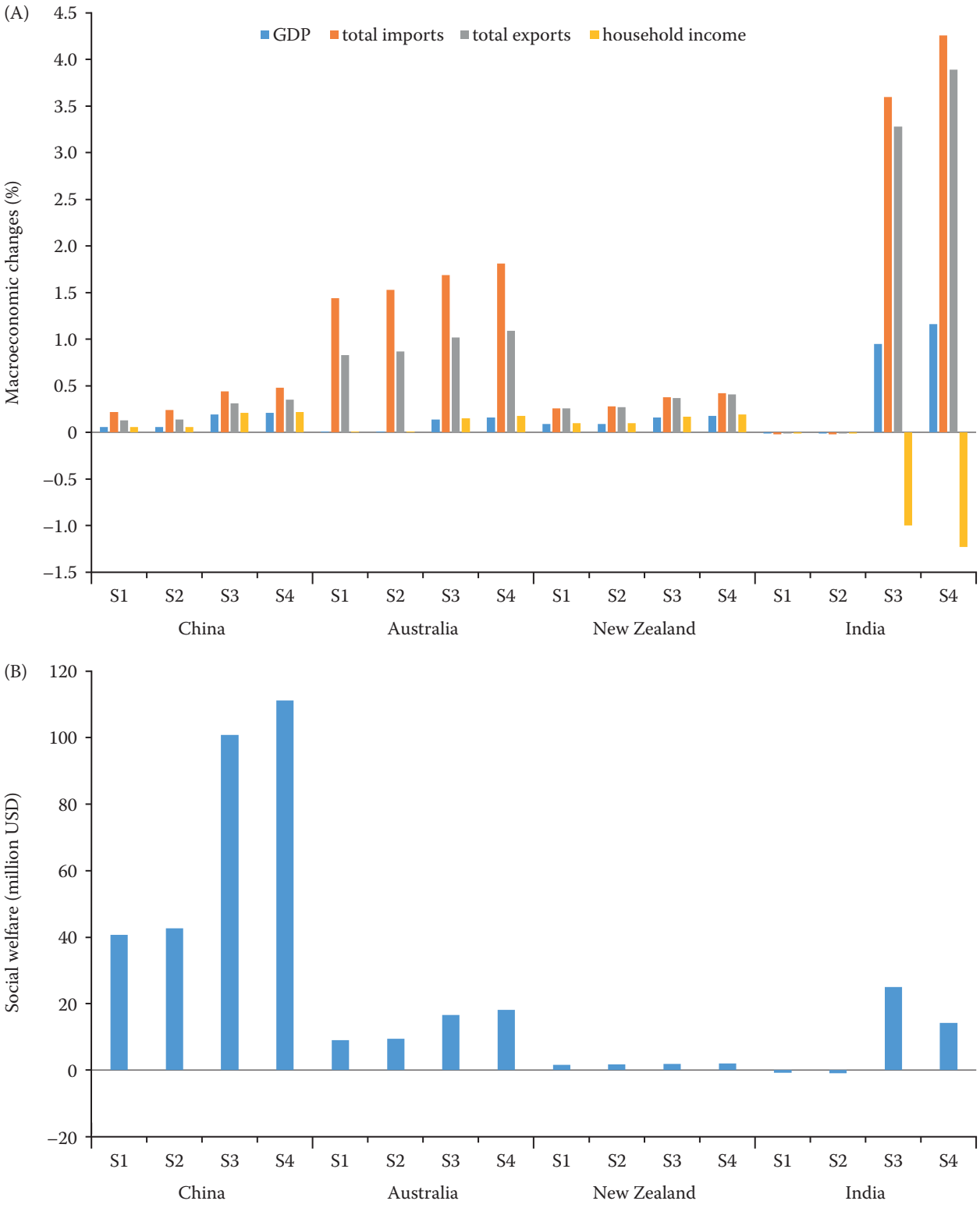


Figure 2. Macroeconomic changes in China, Australia, New Zealand, and India under different scenarios of RCEP implementation

RCEP – Regional Comprehensive Economic Partnership
Source: Author's simulation of GTAP Version 10

https://doi.org/10.17221/327/2023-AGRICECON

***Effect on China and India's major agricultural sectors' imports and exports.*** For China, with the implementation of RCEP, there will be a significant increase in imports of beef products, dairy products, wool and wheat, outweighing the minor decrease in imports of sugar crops. This growth in imports is notably higher for these specific agricultural sectors compared with other sectors. Moreover, the longer the duration of RCEP's implementation, the more pronounced the increase in imports becomes. After 20 years of RCEP implementation, China's imports of sugar crops will decrease by 0.30%. However, imports of beef products, dairy products, wool and wheat from Australia and New Zealand, the major trading partners, will increase by 19.63%, 9.83%, 1.41% and 1.22%, respectively. These values are higher than those observed after 10 years of RCEP implementation by 1.38%, 0.62%, 0.07% and 0.06%, respectively.

Considering India's potential accession, the effect of India joining RCEP on China's major agricultural sectors' imports becomes more significant. Because of the increasing share of Indian imports of agricul-

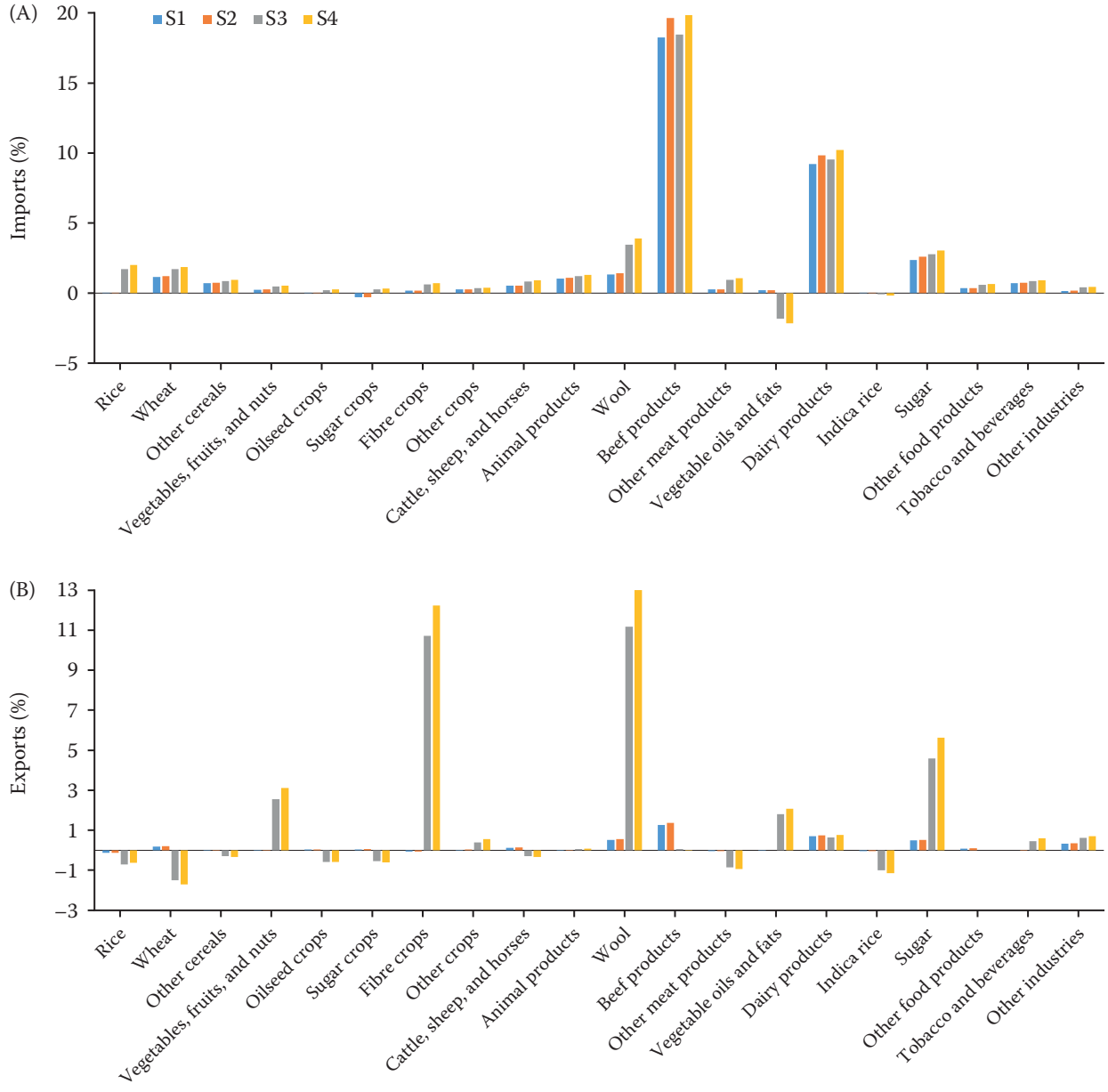


Figure 3. Changes in China's major agricultural sector imports and exports under different RCEP Scenarios.

RCEP – Regional Comprehensive Economic Partnership
Source: Author's simulation of GTAP Version 10

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tural fertilisers from China, it is possible that India could rejoin RCEP soon. Similar to what happens in scenarios S1 and S2, besides substantial growth in imports of beef products, dairy products, wool and wheat from China, India's accession to RCEP will also have a substantial effect on China's rice industry. After 20 years of RCEP implementation, India's accession will lead to a 2.0% increase in China's rice imports, mainly because India is the world's largest rice exporter, accounting for more than 40% of global rice exports.

In terms of exports, the effect on China's agricultural product exports is relatively minor after RCEP takes effect. The export of beef products experiences a slight increase, with growth of 1.36% in the scenario of RCEP being effective for 20 years. Other agricultural sectors show varying degrees of export fluctuations, but the changes are insignificant, mainly because China's main agricultural sectors will lose international competitiveness (Figure 3 and Table S4 in the ESM). However, with India's participation in RCEP, China's exports of wool, fibre crops, sugar, vegetables, fruits and nuts all increase against the trend. Similar to the growth rates in scenario S3, the growth rates of wool, fibre crops, sugar, and vegetables, fruits and nuts. in scenario S4 are 13.01%, 12.24%, 5.63% and 3.11%, respectively. Nonetheless, there will still be an effect on China's grain exports, with rice, wheat, other cereals and bran rice exports decreasing by 0.63%, 1.72%, 0.34% and 1.15%, respectively.

The effect on India's main agricultural sectors' imports and exports is not substantial after RCEP takes effect. Most agricultural sectors experience slight decreases in imports and exports, but the magnitudes of the decreases are small. However, once India becomes a part of RCEP, it will significantly boost imports and exports in its main agricultural sectors. In scenario S4, India's imports of other crops, wheat, plant oils and wool are projected to increase by 129.10%, 77.81%, 73.75% and 56.48%, respectively.

Table 4. Changes in India's agricultural major sector imports and exports under different scenarios of RCEP implementation

| Sector | Import changes (%) | | | | Export changes (%) | | | |
|---|---|---|---|---|---|---|---|---|
| | S1 | S2 | S3 | S4 | S1 | S2 | S3 | S4 |
| Rice | 0.00 | 0.00 | –8.84 | –10.38 | –0.02 | –0.02 | 15.43 | 18.52 |
| Wheat | –0.72 | –0.77 | 63.74 | 77.81 | 0.47 | 0.50 | 9.52 | 11.28 |
| Other cereals | –0.06 | –0.06 | –1.92 | –2.26 | –0.02 | –0.02 | 2.38 | 2.82 |
| Vegetables, fruits, and nuts | –0.02 | –0.02 | 2.12 | 2.72 | –0.01 | –0.01 | 4.69 | 5.59 |
| Oilseed crops | –0.01 | –0.01 | –25.97 | –29.54 | 0.04 | 0.04 | 25.97 | 30.96 |
| Sugar crops | –0.06 | –0.06 | 0.13 | 0.15 | –0.04 | –0.05 | 7.57 | 9.02 |
| Fiber crops | –0.03 | –0.03 | –0.02 | –0.09 | –0.08 | –0.08 | 4.63 | 5.50 |
| Other crops | –0.02 | –0.02 | 97.63 | 129.10 | –0.01 | –0.01 | 12.79 | 15.53 |
| Cattle, sheep, and horses | 0.10 | 0.10 | –2.34 | –2.74 | 0.06 | 0.06 | 7.34 | 8.78 |
| Animal products | –0.02 | –0.02 | –0.85 | –1.06 | –0.02 | –0.02 | 4.13 | 4.93 |
| Wool | –0.19 | –0.21 | 47.03 | 56.48 | –0.36 | –0.38 | 33.04 | 40.35 |
| Beef products | –0.06 | –0.06 | 12.26 | 16.21 | 0.22 | 0.23 | 2.61 | 3.08 |
| Other meat products | –0.02 | –0.02 | 6.17 | 9.23 | –0.03 | –0.03 | 21.04 | 25.47 |
| Vegetable oils and fats | –0.01 | –0.01 | 59.57 | 73.75 | –0.03 | –0.03 | 34.07 | 41.19 |
| Dairy products | –0.03 | –0.03 | 13.76 | 17.83 | –0.04 | –0.04 | 5.59 | 6.67 |
| Indica rice | –0.01 | –0.01 | 9.65 | 13.55 | –0.02 | –0.02 | 2.76 | 3.29 |
| Sugar | –0.01 | –0.01 | 1.94 | 2.54 | –0.03 | –0.03 | 3.94 | 4.69 |
| Other food products | –0.01 | –0.02 | 26.06 | 31.72 | –0.02 | –0.02 | 5.53 | 6.58 |
| Tobacco and beverages | –0.01 | –0.01 | 9.47 | 12.99 | –0.02 | –0.02 | 0.97 | 1.16 |
| Other industries | –0.01 | –0.02 | 1.25 | 1.43 | –0.01 | –0.01 | 2.34 | 2.78 |

RCEP – Regional Comprehensive Economic Partnership
Source: Author's simulation of GTAP Version 10.

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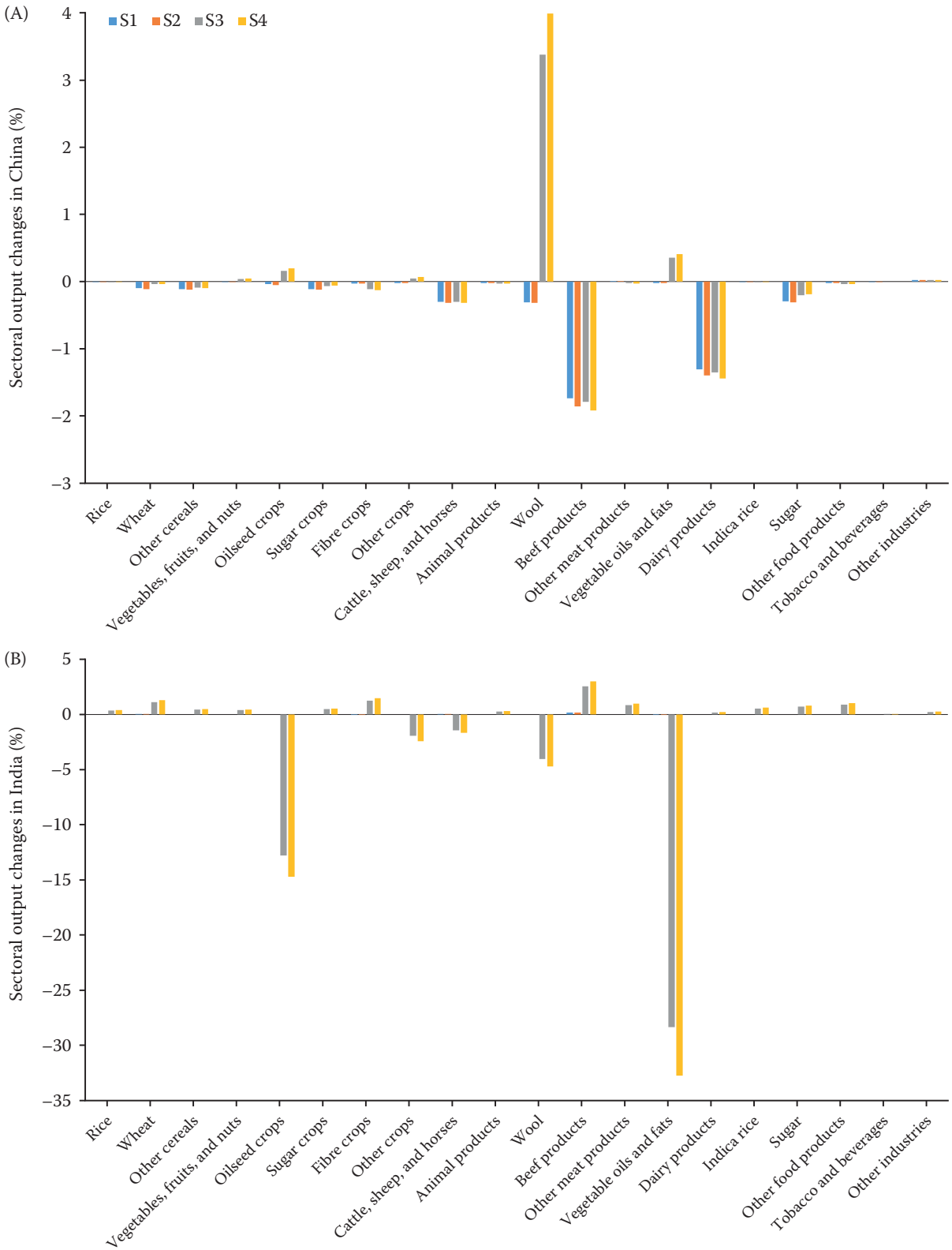


Figure 4. Changes in agricultural major sector output for China and India under different scenarios after RCEP implementation

RCEP – Regional Comprehensive Economic Partnership
Source: Author's simulation of GTAP Version 10

https://doi.org/10.17221/327/2023-AGRICECON

These growth rates are notably higher than those in scenario S3. However, in scenario S4, India's imports of oilseeds and rice are projected to decrease by 29.54% and 10.38%, respectively. India's exports of plant oils, wool, oilseeds, other meat products, rice and wheat are projected to increase by 41.19%, 40.35%, 30.96%, 25.47%, 18.52% and 11.28%, respectively, also surpassing rates in scenario S3 (Table 4).

***Effect on the agricultural output of China's and India's key sectors.*** The implementation of RCEP has a significant effect on the major agricultural sectors of China, whereas its effect on India is minimal. Looking at China, under scenarios S1 and S2, shows that the output of all agricultural sectors except for other meats remains relatively unchanged. However, the output of other agricultural sectors decreases. Among these, the production of beef products and dairy products sees the most substantial decrease, with decreases of 1.86% and 1.40%, respectively, under scenario S2. In the long term, China's reliance on Australia and New Zealand for beef products and dairy products is expected to increase. This trend is unlikely to be altered even if India joins RCEP (Figure 4 and Table S5 in the ESM).

However, when we examine scenarios S3 and S4, India's entry into RCEP after 20 years will increase China's self-sufficiency rates for wool, vegetable oils and oilseeds, but the output of other agricultural sectors remains unchanged compared with the changes seen in scenarios S1 and S3. India's production of vegetable oils, oilseeds and wool, though, shows a significant downward trend. Under scenario S4, the output of these sectors is projected to decrease by 32.76%, 14.70% and 4.70%, respectively.

## CONCLUSION

In this study, we analysed the evolution of agricultural trade structures in CAN under different scenarios since 2000. We summarised the tariff concession patterns of agricultural products among the CAN countries within the RCEP framework. Furthermore, we used the GTAP model to simulate and analyse the economic effects of RCEP implementation and India's potential accession to RCEP.

We drew the following conclusions. The agricultural trade among the CAN countries has experienced rapid growth since 2000, which might be caused by bilateral and multiregional FTAs such as RCEP. China mainly imports wool, beef and its products, dairy products and wheat from Australia and New Zealand (a main global producer of animal products), while exporting primarily processed agricultural products such as vegetables and aquatic products. Under the RCEP framework, Australia and New Zealand have higher levels of tariff liberalisation for agricultural products than does China. In the RCEP FTA, China classified certain agricultural products such as beef, some dairy products, grains and wool imported from Australia and New Zealand as sensitive items, whereas Australia and New Zealand have fewer sensitive items concerning China's exports. This simulation concerns India's withdrawal, but it is possible that India may soon rejoin RCEP as considered under different scenarios.

RCEP implementation will promote macroeconomic growth in CAN. The longer the implementation period, the more pronounced the welfare-promoting effects. However, for certain agricultural products, such as beef, dairy products and wheat imported from Australia and New Zealand, China's imports will increase significantly, decreasing domestic production and self-sufficiency. According to these results, Chinese policymakers could be better off paying attention to the producer's incentives to secure local production and ensure achieving self-sufficiency in the future. India's accession to RCEP will significantly promote macroeconomic growth in CAN and India. The magnitude of welfare promotion will be more apparent with longer RCEP implementation and higher levels of India's openness to RCEP member countries. Concerning agricultural products, India's exports of vegetable oils, wool, oilseeds and other meats will all increase significantly. However, the increased rice and wheat imports from India will affect China's exports and production of grain products. This situation could be a challenge, but according to the global food system transformation to increase the plant-based food system, the surplus for export from China will be lower, which could contribute to overcoming this challenge.

**Policy recommendations.** On the basis of the current results, we summarise the policy recommendations as follows. China should develop protective measures for key agricultural products such as grains and animal protein source products to protect the local producers and ensure self-sufficiency and food security. As international agricultural markets become more volatile owing to geopolitical conflicts (Kafando and Sakurai 2024), climate change and trade restrictions, China should prepare protective measures for key agricultural products that might be significantly affected by RCEP implementation, such as grains, beef and mutton, dairy products and wool. China should also actively implement the diversification strategy of agri-

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cultural import sources, which can increase the import of beef and mutton from Brazil, Argentina and other countries to mitigate the risk of excessive concentration of these agricultural import sources. The structure of agricultural production should be adjusted concurrently with the promotion and facilitation of domestic animal husbandry development. Finally, to enhance emergency management capacity within the food supply chain, a comprehensive macroeconomic regulation, risk monitoring and emergency response system should be established for key agricultural products, along with an improved capability for monitoring supply-demand situations and price fluctuations.

China should strengthen supply security for key agricultural products. For example, China continues to enhance the quality of its free trade zones, and upgrading the quality of such zones is an inevitable trend. RCEP implementation can provide additional support to China's agricultural market, so it is crucial to prioritise enhancing the supply security for key agricultural products. Amid the increasing risks in the international agricultural market, investing in agricultural technology, incentivising innovation in 'bottleneck' technologies and advancing digital agriculture are essential. Using digital technology can ensure smooth domestic agricultural product supplies. For example, the new seeds and breed varieties will increase the grain and animal unit productivity, which could increase international trade and ensure self-sufficiency in the future. The simultaneous improvement of self-cultivated varieties' performance level, acceleration of industrial application and achievement of autonomous and controllable provenance are essential. For the provenance that lags behind foreign countries in areas such as pigs, dairy cows, beef cattle and sheep, efforts will be made promptly to narrow the gap with international advanced levels in key production performance aspects like feed conversion ratio and litter size. Furthermore, strengthening international cooperation to diversify the import of agricultural products is vital to maintaining the stability of the global agricultural supply chain through different bilateral and multiregional FTAs such as RCEP.

China, together with other RCEP member countries, should actively promote India's accession to RCEP. India's participation would foster macroeconomic growth and mitigate welfare losses and trade diversion effects. Moreover, India's inclusion could amplify the positive effect of RCEP on China's economic growth. As a significant agricultural exporting country, India's accession to RCEP would allow China to benefit from reduced tariffs on key imports like rice, wheat and cotton, which could alleviate limitations in China's feed grain supply. Although RCEP came into force without India, it still left India with a special access clause. RCEP is still open to India and attaches great importance to it. In RCEP, Japan and South Korea have advantages in the high-end value chain, China has advantages in manufacturing scale, ASEAN has geographical advantages, Australia and New Zealand have resource advantages and India possesses a sole advantage in terms of labour costs which can be harnessed only through further reforms and increased openness. Thus, China should collaborate with other RCEP member countries to address India's concerns and create conditions for India to return to negotiations, and RCEP member states can design their opening terms specifically for India, especially for the services sector, which is of concern to India, to ease their opening process further. In addition, from the perspective of tariff reduction on goods, on the basis of maintaining the ultimate degree of trade liberalisation to 80%, the extent of tariff reduction can be relaxed at the initial stage as appropriate.

On the basis of the current study's limitations, we suggest areas for future research that could simulate the effect of the high growth rate of India's population on food production, trade and security in the future. At the same time, assessing the effects of current geopolitical conflicts on global and regional food system transformation is required to understand the significant role of regional agreements such as RCEP better.

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