Pre-assessment of the Impacts of the RMB/USD Exchange Rate's Depreciating on China's Economy and Trade

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Abstract. Recently, the pace and intensity of China's loose monetary policy has continued to increase, and the short-term interest rate gap between China and the United States has fallen sharply, which may trigger the depreciation of RMB/USD. This study converts the changes in the exchange rate of RMB/USD into the equivalent value of China's export subsidies and import tariff changes, and then uses the GTAP model to analyze the macroeconomic and industrial impacts of the exchange rate's depreciating on China. The research results are as follows: Firstly, the decline of the RMB exchange rate has double impacts on China's macro-economy. On the one hand, it may lead to an increase in China's GDP, residents' income, and foreign trade surplus. On the other hand, it may cause a decline in the welfare benefits of China's household consumption, and the net return on capital repatriation and social welfare. Secondly, the depreciation of the exchange rate also may have two effects on China's industries. On the one hand, it may expand China's exports. On the other hand, it may lead to a decline in China's output and imports, and also increase China's price level.

Keywords: RMB Exchange Rate Declining · Economic Impacts · GTAP

1 Introduction

Since June 2020, China has controlled the "COVID-19" and restored economic growth, and China's domestic monetary policy has not continued to ease, while economic activity in developed countries has not been returned to normal and can only be maintained by loose monetary policy, which leads to the fall of the US dollars index and the interest rate gap between USA and China rises to 2%. As a result, China's current account has continued to run a surplus, and foreign capital has continued to flow into the domestic bond and stock markets. In the past year, the CFETS RMB exchange rate index rose by 7%, and RMB/USD exchange rate rose by 10%. But it is worth noting that Fed Chairman Jerome Powell said at a Senate hearing on January 11, 2022, considering his re-election nomination, that the US economy no longer needed highly loose monetary

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policy. Recently, the pace and intensity of China's loose monetary policy has continued to increase, with a significant imbalance in domestic and foreign monetary policy and a sharp drop in the short-term interest rate difference between China and USA, which may trigger the depreciation of RMB/USD. The USD is wildly used in international trade, and China is a major importer and exporter. What impacts may a depreciating exchange rate of RMB/USD have on China's economy and trade? Hence, it is essential to study furtherly.

The recent literature mainly discussed on the impacts of the RMB devaluation on China's imports and exports, domestic prices. Li et al. (2018) [13] and Shi (2018) [6] analyzed on the impacts of the RMB devaluation on China, who argued that the RMB devaluation was beneficial to mitigate the impacts of Sino-US trade frictions on China's exports, but it would trigger an increase in the prices of China's imports, which not only curbed the development of China's imports, but also pushed up the domestic inflation level. Some scholars also analyzed the impacts of the RMB devaluation on China's foreign trade, commodity prices, and outputs. Cui (2019) [8] used the model of regression to investigate the relationship between the RMB exchange rate and China's imports, and the study showed that the RMB devaluation led to a decrease in China's imports. Wang et al. (2019) [5] who used a partial equilibrium model to analyze the impacts of the exchange rate fluctuations on China's agricultural prices, trade and production, found that the RMB devaluation led to higher prices for China's imports, reduced imports, increased demand for domestic agricultural products, and raised the output of China's agricultural products, such as rice, wheat, corn, beef, pork and milk powder, etc.

In addition, earlier literature studied the effects of a country's currency devaluation on its GDP, output, and imports and exports. Hu (1996) [14] used the model of regression to analyze the effect of the RMB devaluation, and found that the RMB devaluation had a boosting effect on China's exports and no significant dampening effect on the imports. Chen (2000) [15] analyzed the impacts of the RMB devaluation on China's economy, and found that the devaluation of RMB led to a decline of China's GNP in US dollars. Lanmb (2000) [7] and Chit et al. (2000) [1] respectively used time series models and panel data models to analyze the impacts of currency exchange rate changes in African and emerging market countries in East Asia, and found that currency devaluation increased agricultural exports and production in these regions.

Several limitations are found as follows: Firstly, the studies mentioned on the effects of a lower RMB exchange rate on China's economy are mostly limited to the exploration of the impacts of import and export, domestic prices, and outputs, and comprehensive research on the impacts of the decline of the RMB exchange rate on China's economic growth, social welfare, residents' income and consumption, import and export trade, terms of trade and capital return is rare. Secondly, the early research mainly used time series model and panel data model for regression analysis, while the multi-national and multi-sectoral general equilibrium model were rarely used to study the various economic effects caused by RMB devaluation. The main reason is that many CGE models (computable general equilibrium model) used to analyze the effects of trade policy do not have the exchange rate policy variables.

Compared with the mentioned literature, the main contribution of this study is to build a computational model to convert the RMB exchange rate variable against the US

dollars into China's export subsidies and import tariffs. Then the global trade analysis model is used to analyze the impacts of the decline of the RMB exchange rate on China's macro-economy and output, import and export trade and product prices, and policy suggestions are put forward.

2 Theory Basis and Research Methods

2.1 Theory

According to the general equilibrium theory, there is an interaction and mutual influence relationship between prices, supply, and demand of various commodities and factors of production [4]. When the price of a commodity or factor of production changes, it will not only cause changes in the price, supply and demand of that commodity or factor of production, but also lead to changes in the supplies and demands and prices of their respective substitutes and complementary goods. The changes in the prices and supply-demand relations of these substitutes and complementary products and their factors of production will further cause the changes in the supply-demand relations and prices of their substitutes and complementary products and their factors of production, which will lead to a chain reaction in various economic and trade activities and bring the economy into a new equilibrium state. A new equilibrium value appears between the prices of all commodities and factors of production and the supply-demand relations. International trade closely links the economic activities of all countries in the world. Changes in the exchange rate of a country's currency will not only lead to changes in the prices and quantities of domestic exports and imports, the output of various departments and the prices and quantities of commodities and production factors in various markets, but also will lead to changes in the prices and supply-demand relationship of various commodities in other trading countries, and then will lead to changes in the equilibrium prices and quantities of various commodities and production factors in the domestic and world markets, until the market is cleared and there is a new equilibrium between supply and demand. Therefore, the impacts of the exchange rate changes on GDP, production, income, consumption, investment and import and export trade of domestic country or other countries can be obtained.

2.2 Model of Analysis

The global CGE model [3, 11], the Global Trade Analysis Project (GTAP) developed by Purdue University of USA are tools for analyzing policy effects (Zhu 2018) [12]. The GTAP model uses the GTAPAgg program, which can be used to classify and sum up countries (regions) and industrial sectors according to the needs of research purposes, and then, by setting policy shock variables and applying the RunGTAP software to analyze different policy effects [9, 10]. At present, the latest GTAP10 model database covers GDP, production, consumption, savings, investment, import and export trade, subsidies, and tariffs of import and export in 141 countries (regions) in the world. This research uses this model for analysis. In order to meet the closure conditions of the model, the 65 product divisions in the GTAP10 model are merged into 33 new product divisions (see Table 1).

Table 1. GTAP10 Comparison of the original 65 product sections merged into 33 product sections

New products divisions	Former products divisions	New products divisions	Former products divisions
Rice	Rice	Chemicals	Chemicals
	Rice		Pharmaceuticals
Wheat	Wheat		Rubber and plastic
Vegetables, fruits and nuts	Vegetables, fruits & nuts		Petroleum and coal products
Edible oil materials	Edible oil materials	Metals and their products and minerals	Ferrous metals
Other grains and agricultural products	Other grains		Other metals
	Sugar		Metal products
	Plant fiber		Metallic minerals
	Other agricultural products	Electronic and electrical equipment	Computer, electronic and optical products
Livestock products	Live cattle, horses and sheep		Electrical equipment
	Other animals and products	Machinery and equipment	Machinery and equipment
	Wool, silkworm cocoon		Other machinery and equipment
	Beef, horse and lamb	Electricity supply	Electricity supply
	Meat products	Natural gas production and retail	Natural gas production and retail
Trees	Trees	Construction	Construction
Aquatic products	Aquatic products	Communications	Communications
Petrochemical energy	Coal	Electricity supply	Electricity supply
	Oil	Transportation	Sea freight
	Natural gas		Air freight
	Other fuels		Other transportation
Vegetable oil	Vegetable oil	Finance and insurance	Finance
Milk and its products	Milk		Insurance
	Dairy products	Entertainment industry	Entertainment
Sugar	Sugar	Other services	Trade
Food	Food		Business
Beverages and tobacco products	Beverages and tobacco products		Storage

(*continued*)

Table 1. (*continued*)

New products divisions	Former products divisions	New products divisions	Former products divisions
Textiles	Textiles		Real Estate
Clothing	Clothing		Business
Leather and its products	Leather and its products		Public service and defense
Furniture and other wood products	Furniture and other wood products		Education
Paper and paper products	Paper and paper products		Health
Transportation equipment and parts	Motor vehicles and parts		Residential property services
	Other transportation equipment and parts		

2.3 Scenarios Setting for the RMB Exchange Rate Changes

In February 2018, the RMB/USD exchange rate was around 6.3, and in May 2020, the exchange rate exceeded 7 and declined by 11%. Hence, this study sets Scenario1 in which RMB/USD exchange rate declines by 11% in as to assess the impacts of the exchange rate changes on China's economy and trade during this period. Because China's economy has huge development potential, and in the long run, the RMB is unlikely to depreciate in a disorderly manner, but in the short run, the RMB/USD exchange rate may further decline due to domestic and foreign economic factors. For this reason, the study sets scenario 2 in which the exchange rate declines by 15% and scenario 3 in which the exchange rate declines by 20% to examine the impacts of a further reduction in the RMB exchange rate on China's economy and trade.

2.4 Calculation of the Magnitude of the RMB Exchange Rate Changes into the Equivalent of Export Subsidies and Import Tariff Changes

Although the GTAP model contains more than thirty exogenous shock variables such as export subsidies and import tariffs, there is no exchange rate variable. The solution to the above problem is to translate the changes in the RMB exchange rate into the equivalent of the changes in export subsidies and import tariffs. In international trade, the US dollars are most wildly used. A decrease in the exchange rate of RMB/USD means that the price of Chinese export denominated in the US dollars is lowered, which is equivalent to giving a certain subsidy to Chinese export, but causes the price of Chinese import priced in RMB being higher, which is equivalent to China imposing a tariff on imports.

2.4.1 Calculation of the Changes in the RMB Exchange Rate Converted into the Changes in Export Subsidy

Equation (1) was constructed by reference the papers of Feenstra (1989) [2] and Li et al. (2008).

$$P_{CHN}^{cif} = P_{CHN}(1 - s) \tag{1}$$

In Eq. (1), P_{CHN}^{cif} is the CIF of Chinese exports in RMB, P_{CHN} is the total cost of China's exports including commodity prices and freight and insurance costs, and s is the tax rebate rate (export subsidy rate) for China's exports.

According to Eq. (1), the CIF-paid price of foreign imports of China's goods (denominated in U.S. dollars) can be expressed by Eq. (2).

$$P_F = P_{CHN}^{cif} \times (1 + m) \times r = P_{CHN} \times (1 - s) \times (1 + m) \times r \tag{2}$$

In Eq. (2), m and r are the foreign import tariff and the RMB/USD exchange rate respectively, and the other symbols are the same as in Eq. (1).

From Eq. (2), it can be seen that, given P_{CHN} and m, a change in export subsidy (s), or a change in the RMB exchange rate (r) will affect the prices of foreign imports of (Chinese) goods (P_F). Set the effect α of a decrease in the RMB exchange rate be equivalent to an increase Δs in China's export subsidy, then Eq. (3) is obtained from Eq. (2).

$$P_{CHN}(1 + m)[1 - (s + \Delta s)]r = P_{CHN}(1 + m)(1 - s)(1 - \alpha)r \tag{3}$$

From Eq. (3), the formula (4) that converts the degree of decrease (α) in the RMB/USD exchange rate to the increase in export subsidies (Δs) is obtained.

$$\Delta s = \alpha(1 + s) \tag{4}$$

2.4.2 Calculation of the Changes in the RMB Exchange Rate Converted into the Changes in Import Tariff

Changes in the RMB exchange rate also affect the prices of China's imports, and a relational equation for the effect of the RMB exchange rate changes on the prices of China's imports is constructed below.

Set P_F^{cif} is the CIF of China's imports denominated in the US dollars, m' is the import tariff of China, and r' is the exchange rate of the US dollars to RMB, then the post-tax price of China's imports denominated in RMB can be expressed by Eq. (5).

$$P_{CHN} = P_F^{cif} \times (1 + m') \times r' \tag{5}$$

Set the effect α of a decrease in the RMB exchange rate is equivalent to an increase Δm in China's import tariffs, and Eq. (6) is gotten from Eq. (5).

$$P_F^{cif} \times (1 + m' + \Delta m) \times r' = P_F^{cif} \times (1 + m') \times (1 + \alpha) \times r' \tag{6}$$

The formula (7) that converts the degrees of the decline in the RMB/USD exchange rate (α) to the changes in import tariffs (Δm) is deduced from Eq. (6).

$$\Delta m = \alpha(1 + m) \tag{7}$$

3 Simulation Analysis of the Impacts of a Decline in the Exchange Rate of RMB/USD on China's Economy and Trade

3.1 Changes in the RMB/USD Exchange Rate Under Different Scenarios Are Equivalent to Changes in Export Subsidies and Import Tariffs

Using the export tax rebate rates of various products in China in 2021 from China Export Tax Rebate Online, the export tax rebate rates (export subsidy rates) for each sector of products are calculated (See column 1 of Table 2), and using the tariff rates of various China's imports in 2021 from the UN COMTRADE database, the import tariff rates for each sector of products are calculated (See column 5 of Table 2). Then, by using Eq. (4) and Eq. (7), the effects of export subsidies and import tariffs equivalents on various products for scenario 1 which is 11% decrease in the RMB/USD exchange rate, scenario 2 which is 15% decrease of the exchange rate and scenario 3 which is 20% decrease of the exchange rate are gotten respectively (See Table 2).

3.2 Impacts on Macro-economy

By using the GTAP model to analyze scenarios of 11%, 15% and 20% decreases in the RMB/USD exchange rate (See Table 2), the macroeconomic impacts of different decreases in the RMB exchange rate on China's economy are obtained (See Table 3).

These three scenarios can improve China's GDP, residents' income, terms of trade, and foreign trade surplus, but may cause to a decline in the welfare benefits of China's household consumption, the net return to capital repatriation, and social welfare. There are differences in the degree of impacts of different scenarios on China's macroeconomic benefits. Specifically, Scenario 1 may raise China's GDP, residents' income, terms of trade and foreign trade surplus by 0.55%, 0.53%, 0.44% and 36.205 billion US$ respectively, but may cause the decreases in China's residents' consumption, the net rate of return to capital and social welfare by 0.16%, 0.92% and 11.922 billion US$ respectively. Scenario 2 may raise China's GDP, residents' income, terms of trade, and foreign trade surplus by 0.95%, 0.94%, 0.51% and 46.298 billion US$ respectively, but may cause the welfare benefits of China's residents' consumption, the net rate of return on capital repatriation and social welfare to fall by 0.31%, 1.05% and 22.892 billion US$ respectively. Scenario 3 (20% decrease in the RMB exchange rate) raises China's GDP, resident income, terms of trade and foreign trade surplus by 1.31%, 1.28%, 0.81% and 67.308 billion US$, but may cause the decreases in the welfare benefits of China's household consumption, the net return to capital repatriation, and social welfare by 0.41%, 1.63% and 31.599 billion US$ respectively. Obviously, the greater the reduction in the RMB exchange rate is, the greater the positive effects on China's economic growth, residents' income and improving the terms of trade may be, but the greater the negative impacts on the welfare benefits of Chinese household consumption, the net rate of return on capital repatriation and social welfare may be.

Table 2. Value of changes in the RMB exchange rate equivalent to changes in export subsidies and import tariffs under different scenarios

Departments	Export refund Tax rate (%)	Changes in the RMB exchange rate equivalent to changes in export subsidy under different scenarios (%)			Import tariff rate (%)	Changes in the RMB exchange rate equivalent to changes in import tariffs under different scenarios (%)		
		Scen1	Scen2	Scen3		Scen1	Scen2	Scen3
Rice	0.0	11.0	15.0	20.0	61.1	17.7	24.1	32.2
Wheat	0.0	11.0	15.0	20.0	62.9	17.9	24.4	32.6
Edible oil materials	0.0	11.0	15.0	20.0	15.7	12.7	17.4	23.1
Vegetables, fruits, nuts	0.0	11.0	15.0	20.0	11.5	12.3	16.7	22.3
Other agricultural products	0.0	11.0	15.0	20.0	16.8	12.8	17.5	23.4
Livestock products	6.0	11.7	15.9	21.2	7.2	11.8	16.1	21.4
Trees	6.0	11.7	15.9	21.2	12.8	12.4	16.9	22.6
Aquatic products	9.0	12.0	16.4	21.8	10.5	12.2	16.6	22.1
Sugar	9.0	12.0	16.4	21.8	33.5	14.7	20.0	26.7
Beverages and tobacco products	9.0	12.0	16.4	21.8	26.2	13.9	18.9	25.2
Food	13.0	12.4	17.0	22.6	12.3	12.4	16.8	22.5
Textiles	13.0	12.4	17.0	22.6	13.5	12.5	17.0	22.7
Clothing	13.0	12.4	17.0	22.6	14.7	12.6	17.2	22.9
Leather and its products	13.0	12.4	17.0	22.6	14.3	12.6	17.1	22.9
Furniture and other wood products	9.0	12.0	16.4	21.8	11.2	12.2	16.7	22.2
Paper and paper products	13.0	12.4	17.0	22.6	8.6	11.9	16.3	21.7
Transportation and its parts	13.0	12.4	17.0	22.6	25.2	13.8	18.8	25.0
Petrochemical energy	0.0	11.0	15.0	20.0	0.0	11.0	15.0	20.0
Chemicals	13.0	12.4	17.0	22.6	11.2	12.2	16.7	22.2

(*continued*)

Table 2. (*continued*)

Departments	Export refund Tax rate (%)	Changes in the RMB exchange rate equivalent to changes in export subsidy under different scenarios (%)			Import tariff rate (%)	Changes in the RMB exchange rate equivalent to changes in import tariffs under different scenarios (%)		
		Scen1	Scen2	Scen3		Scen1	Scen2	Scen3
Metals and their products and minerals	6.0	11.7	15.9	21.2	6.7	11.7	16.0	21.3
Electronic and electrical equipment	13.0	12.4	17.0	22.6	6.6	11.7	16.0	21.3
Machinery and equipment	13.0	12.4	17.0	22.6	6.8	11.7	16.0	21.4
Other equipment	13.0	12.4	17.0	22.6	6.8	11.7	16.0	21.4
Power	0.0	11.0	15.0	20.0	0.0	11.0	15.0	20.0
Natural gas production and retail	0.0	11.0	15.0	20.0	0.0	11.0	15.0	20.0
Water supply	0.0	11.0	15.0	20.0	0.0	11.0	15.0	20.0
Architecture	0.0	11.0	15.0	20.0	0.0	11.0	15.0	20.0
Communication	0.0	11.0	15.0	20.0	0.0	11.0	15.0	20.0
Shipping	0.0	11.0	15.0	20.0	0.0	11.0	15.0	20.0
Business	0.0	11.0	15.0	20.0	0.0	11.0	15.0	20.0
Financial insurance	0.0	11.0	15.0	20.0	0.0	11.0	15.0	20.0
Entertainment	0.0	11.0	15.0	20.0	0.0	11.0	15.0	20.0
Other services	0.0	11.0	15.0	20.0	0.0	11.0	15.0	20.0

Note: The values in columns 3, 4 and 5 in Table 2 are the decline of the RMB exchange rate against the US dollars by 11%, 15% and 20% respectively, which is equivalent to the increase of export subsidies for various commodities. The values in columns 7, 8 and 9 are the decline of the RMB exchange rate against the US dollars by 11%, 15% and 20% respectively, which is equivalent to the increase of import tariffs for various commodities

3.3 Impacts on China's Industries

The outputs, imports, exports and products price impacts of the three scenarios of the RMB/USD exchange rate changes on China's industries can also be obtained (See Table 4, Table 5 and Table 6).

The impacts on China's outputs. The study results show that scenario 1, scenario 2 and scenario 3 may cause China's total outputs decreases of 0.69%, 0.76% and 1.15%

Table 3. The impacts of different scenarios on China's macroeconomy

Scenarios	GDP changes (%)	Changes in residents' income (%)	Changes in welfare benefits of household consumption (%)	Changes in net return on capital repatriation (%)	Changes in terms of trade (%)	Changes in trade balance (million US$)	Changes in social benefits (million US$)
Scenario 1	0.55	0.53	−0.16	−0.92	0.44	36205.12	−11922.12
Scenario 2	0.95	0.94	−0.31	−1.05	0.51	46298.96	−22892.76
Scenario 3	1.31	1.28	−0.41	−1.63	0.81	67308.23	−31599.43

respectively. This indicates that a lower RMB exchange rate may lead to a decrease in China's output, and the greater the decrease in the RMB exchange rate is, the greater the decrease in China's outputs may be. In terms of the impacts on different industries, the decline of the RMB exchange rate may lead to the decline of the outputs of rice, wheat, livestock products, sugar, other agricultural products, beverages and tobacco products, apparel, textiles, transportation and parts thereof, natural gas production, retailing, construction, electricity, and other services and transportation (among which the outputs of textiles, apparel, and sugar decrease more). And the greater the decrease in the RMB exchange rate is, the more the output level of the above-mentioned industrial sectors may decline. However, the outputs of the other 19 sectors (among which the output of electronics and electrical equipment rise by more than 9%) rise, and the greater the drop in the RMB exchange rate is, the more the output of these industries may increase.

The impacts on China's exports. Scenario 1, Scenario 2 and Scenario 3 may increase China's total exports by 3.6%, 3.32% and 2.17% respectively, which indicates that the improvements in China's total exports diminish gradually with the RMB exchange rate decreasing continuously. In terms of changes in exports sectors, the lower RMB exchange rates may cause different degrees of growth in China's exports in the vast majority of industries, which are wheat, sugar, livestock products, milk and its products, rice, and other agricultural products. However, the export scale of petrochemical energy, clothing, textiles, other equipment, transportation, other services, natural gas production and retail industry may be reduced. Among them, the export of petrochemical energy, clothing and other services may decrease greatly.

The impacts on China's imports. In contrast to the impacts on exports, these three scenarios may reduce China's imports in most sectors, which result in reduction of China's imports. However, there are some differences in the impacts of different scenarios. Scenario 1, Scenario 2 and Scenario 3 may reduce China's total imports by 3.28%, 3.77% and 6.13% respectively. This indicates that the greater the decrease in the RMB exchange rate is, the greater the negative impacts on China's imports may be caused. In terms of the import changes of various industries, on the one hand, the

Table 4. Scenario 1: Impacts of 11% decrease in the RMB/USD exchange rate on China's industries

Departments	Changes in outputs (%)	Changes in exports (%)	Changes in imports (%)	Changes in commodity prices (%)
Rice	−0.65	16.99	−19.99	4.90
Wheat	−0.33	28.16	−21.72	5.13
Vegetables, fruits, nuts	0.06	9.87	−7.66	6.89
Edible oil materials	1.90	12.52	−2.99	5.23
Other agricultural products	−2.74	16.73	−7.57	4.62
Livestock products	−0.74	23.60	21.69	6.84
Trees	2.23	8.27	−9.32	6.15
Aquatic products	0.36	4.20	2.51	5.99
Petrochemical energy	2.61	−94.09	−8.16	5.64
Milk and its products	0.05	23.32	2.19	5.02
Sugar	−13.84	23.88	59.05	3.41
Beverages and tobacco products	−0.01	6.67	6.77	5.21
Food	0.61	10.51	3.76	5.27
Textiles	−9.52	−9.45	−10.37	5.35
Clothing	−15.96	−40.80	−2.27	5.38
Furniture and other wood products	1.07	0.03	−13.35	5.93
Paper and paper products	1.68	5.91	−10.31	5.80
Transportation and parts thereof	−4.14	4.12	21.43	5.23
Metals and their products and minerals	1.02	6.08	9.59	5.84
Chemicals	0.36	2.88	0.14	5.97
Electronic and electrical equipment	8.86	9.49	−4.87	6.21
Machinery and equipment	0.27	4.01	2.86	5.89

(*continued*)

Table 4. (*continued*)

Departments	Changes in outputs (%)	Changes in exports (%)	Changes in imports (%)	Changes in commodity prices (%)
Other equipment	0.06	−5.88	−5.98	6.79
Architecture	−0.61	8.99	−10.88	5.95
Power	−0.33	6.17	−11.88	5.13
Natural gas production and retail	−0.85	−1.05	−8.14	5.51
Water supply	0.08	15.58	−16.18	5.48
Communication	0.34	11.15	−11.08	5.37
Transportation	−0.01	−1.62	−10.19	5.81
Business	0.83	11.45	−11.17	5.21
Finance and insurance	0.65	11.83	−11.26	5.22
Entertainment industry	0.42	11.36	−11.32	5.30
Other services	−0.31	−22.24	−11.41	5.29
Overall	−0.69	3.60	−3.28	5.67

lower RMB exchange rate may lead to significant decreases in imports in 23 sectors, which are wheat, rice, water supply, furniture and other wood products, electricity, other services, entertainment, finance and insurance, commerce, communications, construction, textiles, paper and paper products, and transportation (among which, the first four sectors may have larger decreases in imports). Moreover, with the increasing decline of the RMB exchange rate, the import scales of these industries are also decreasing. On the other hand, China's imports of sugar, livestock products, means of transportation and their parts, metals and their products and minerals, beverages and tobacco products, food, machinery and equipment, aquatic products, chemicals, milk and its products may expand. With the RMB exchange rate decreasing, the import scales of these industries may also continue to increase.

The impacts on China's commodities prices. The above three scenarios may all bring about different increases of prices for various products sectors in China, which may increase the overall level of commodity prices in China, but there are significant differences in the impacts of the different scenarios. Specifically, Scenario 1, Scenario 2 and Scenario 3 may increase the overall level of commodities prices in China by 5.67%, 10.03% and 13.74% respectively. This suggests that the greater the decline in the RMB exchange rate is, the greater the improving effects on the price may be taken. Judging from the changes in the prices of products in various sectors, the lower RMB exchange rate has a great effect on the price increase of agricultural products such as vegetables, fruits, nuts and livestock products.

Table 5. Scenario 2: Impacts of 15% decrease in the RMB/USD exchange rate on China's industries

Departments	Changes in output (%)	Changes in exports (%)	Changes in imports (%)	Changes in commodity prices (%)
Rice	−0.58	17.12	−20.36	9.31
Wheat	−0.19	28.66	−21.9	9.54
Vegetables, fruits, nuts	0.07	9.91	−7.79	11.29
Edible oil materials	1.99	12.56	−2.95	9.65
Other agricultural products	−2.55	16.75	−7.34	9.04
Livestock products	−0.57	23.81	17.63	11.24
Trees	2.43	8.29	−9.33	10.55
Aquatic products	0.33	4.42	2.18	10.26
Petrochemical energy	2.72	−94.59	−8.16	10.11
Milk and its products	0.24	23.73	−1.55	9.41
Sugar	−13.82	24.04	58.88	7.80
Beverages and tobacco products	−0.03	6.86	6.39	9.55
Food	0.59	10.76	3.49	9.63
Textiles	−8.91	−9.25	−10.03	9.72
Clothing	−14.72	−37.52	−2.57	9.73
Furniture and other wood products	1.28	0.36	−13.62	10.29
Paper and paper products	1.75	6.33	−10.64	10.15
Transportation and its parts	−3.67	4.30	18.75	9.64
Metals and their products and minerals	1.24	6.48	9.37	10.21
Chemicals	0.58	3.3	−0.04	10.34
Electronic and electrical equipment	9.31	10.05	−4.92	10.57
Machinery and equipment	0.52	4.6	2.58	10.25

(*continued*)

Table 5. (*continued*)

Departments	Changes in output (%)	Changes in exports (%)	Changes in imports (%)	Changes in commodity prices (%)
Other equipment	0.21	−5.57	−6.06	11.17
Architecture	−0.68	9.42	−11.15	10.3
Power	−0.24	6.5	−11.98	10.53
Natural gas production and retail	−0.96	−0.99	−8.31	10.95
Water supply	0.02	16.3	−16.65	9.81
Communication	0.27	11.66	−11.4	9.68
Transportation	−0.24	−4.62	−10.43	10.16
Business	0.83	11.94	−11.46	9.52
Finance and insurance	0.64	12.46	−11.64	9.51
Entertainment industry	0.27	11.9	−11.75	9.61
Other services	−0.67	−40.31	−11.74	9.57
Overall	−0.76	3.32	−3.77	10.03

Table 6. Scenario 3: Impacts of 20% decrease in the RMB/USD exchange rate on China's industries

Departments	Changes in output (%)	Changes in exports (%)	Changes in imports (%)	Changes in commodity prices (%)
Rice	−0.58	16.41	−23.81	12.96
Wheat	−0.15	27.45	−25.51	13.22
Vegetables, fruits, nuts	0.1	9.45	−10.99	16.95
Edible oil materials	3.26	10.85	−3.80	13.54
Other agricultural products	−1.21	15.01	−15.57	12.93
Livestock products	−0.57	23.04	14.86	16.90
Trees	2.85	7.78	−11.25	14.19
Aquatic products	0.32	4.44	0.79	13.74
Petrochemical energy	3.26	−102.14	−9.14	13.32

(*continued*)

Table 6. (*continued*)

Departments	Changes in output (%)	Changes in exports (%)	Changes in imports (%)	Changes in commodity prices (%)
Milk and its products	0.12	23.13	−1.42	13.05
Sugar	−13.51	22.48	57.41	11.66
Beverages and tobacco products	−0.04	6.64	5.31	13.21
Food	0.55	10.24	1.73	13.33
Textiles	−9.18	−10.45	−13.01	13.52
Clothing	−14.95	−38.16	−5.82	13.43
Furniture and other wood products	1.29	−0.23	−16.56	13.96
Paper and paper products	2.35	10.77	−12.87	13.84
Transportation and its parts	−2.86	9.19	16.51	13.37
Metals and their products and minerals	1.17	5.63	6.17	13.92
Chemicals	0.93	2.04	−2.18	14.10
Electronic and electrical equipment	9.26	8.83	−7.65	14.35
Machinery and equipment	0.72	3.67	−0.4	13.96
Other equipment	0.23	−7.29	−8.24	14.99
Architecture	−1.06	9.19	−13.26	13.96
Power	−0.2	4.61	−13.79	15.41
Natural gas production and retail	−1.51	−4.25	−9.56	15.10
Water supply	0.01	16.53	−19.59	13.33
Communication	0.21	11.92	−13.48	13.18
Transportation	−0.50	−7.52	−12.22	13.79
Business	0.89	12.23	−13.46	13.01
Finance and insurance	0.67	13.02	−13.8	12.93
Entertainment industry	0.22	12.12	−13.82	13.11
Other services	−0.92	−54.91	−13.85	13.04
Overall	−1.15	2.17	−6.13	13.74

4 Conclusions and Policy Suggestions

This study uses the GTAP model to analyze the impacts of the RMB/USD exchange rate's depreciating on China's economy and trade from both macroeconomic and industrial sectors, and the following conclusions and policy suggestions are obtained.

4.1 Conclusions

Firstly, the decline of the RMB exchange rate can increase China's GDP, residents' income and improve the terms of trade. Moreover, the greater the decline of the RMB exchange rate is, the greater the promotion of the above macroeconomic benefits may be. However, it may lead to the decline of the welfare benefits of China's household consumption, the net return on capital return and social welfare, and may also cause the expansion of China's foreign trade surplus. Moreover, the greater the decline of the RMB exchange rate is, the greater the negative impact on these aspects may be caused.

Secondly, the RMB exchange rate's depreciating may promote China's exports, and the greater the decline in the RMB exchange rate is, the greater the promotion of China's exports may be. However, it may cause a decline in China's outputs and imports, and also lead to an increase of the level of prices in China. Meanwhile, the greater the decline in the RMB exchange rate is, the greater these negative effects may be.

4.2 Policy Suggestions

Firstly, the positive effects of the RMB exchange rate's falling on boosting exports and economic growth should be paid attention to. From April 2018 when the trade war between China and USA took place, to May 2020, the RMB exchange rate against the US dollars fell by about 11%. The study shows that the RMB exchange rate's declining during the above period boosted China's GDP and export trade by 0.55% and 3.6% respectively. China's statistics shows that China's exports have maintained sustained growth since the first half of 2019. This also corroborates the positive effects of the RMB exchange rate's changes on improving the growth of exports and reducing the impacts of trade frictions between China and USA. Therefore, China should maintain the flexibility of the RMB exchange rate's changes to reduce the negative impacts of external factors on China's exports and economic growth.

Secondly, the impacts of a falling RMB exchange rate on domestic prices and residents' living standards should be highly concerned about. The decline in the exchange rate of RMB/USD may lead to an increase in the overall level of prices in China, and may also reduce social welfare and residents' real income in China. This study also shows that if the RMB exchange rate falls further, it may further push up the domestic price level. Hence, the plan to increase the supply of important agricultural products such as vegetables, fruits and livestock should be taken in order to stabilize market prices.

Thirdly, great importance to the impacts of a lower RMB exchange rate on domestic capital returns should be attached to prevent large capital outflows. The study shows that a lower RMB exchange rate will reduce China's net return on capital repatriation. Therefore, China should deepen reforms to reduce various burdens of enterprises in

order to reduce their operating costs, create more favorable development environment to improve the enterprises' net return on capital.

Fourthly, the research shows that the depreciation of the RMB exchange rate has side effects on China's imports, which may further improve the surplus of China's foreign trade. Being the largest exporter and trade surplus country of the US, if China's trade surplus grows further, it may provide more excuses for US to implement trade protectionism and unilateralism policies under the current situation. Therefore, China should adopt the strategy of balanced development of import and export trade. While paying attention to the development of export trade, China should actively expand imports and reduce the foreign trade surplus.

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