

THE IMPACT OF MACROECONOMIC FACTORS ON CHINA'S EXPORTS AND IMPORTS

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Abstract

This study examines the impact of macroeconomic factors including real effective exchange rate index and volatility, foreign direct investment, industrial production index, gross domestic product, growth rate of foreign income, foreign direct investment, industrial production index, tariff rate, growth rate of sample countries, growth rate of gross domestic product, a series of data on the exports and imports from the period of 2001 – 2014. Besides, it provides some brief policy suggestions based on these factors. According to empirical results, the volatility of real effective exchange rate has a significantly negative effect on China's exports while the growth rate of foreign income affects China's exports positively. Moreover, the real effective exchange rate and volatility also have negative effects on China's imports and there is a significantly positive correlation between domestic GDP and China's imports.

Keywords:

Real effective exchange rate, Volatility of real effective exchange rate, Industrial Production Index, Tariff rate, Foreign direct investment, Exports, Imports.

Introduction

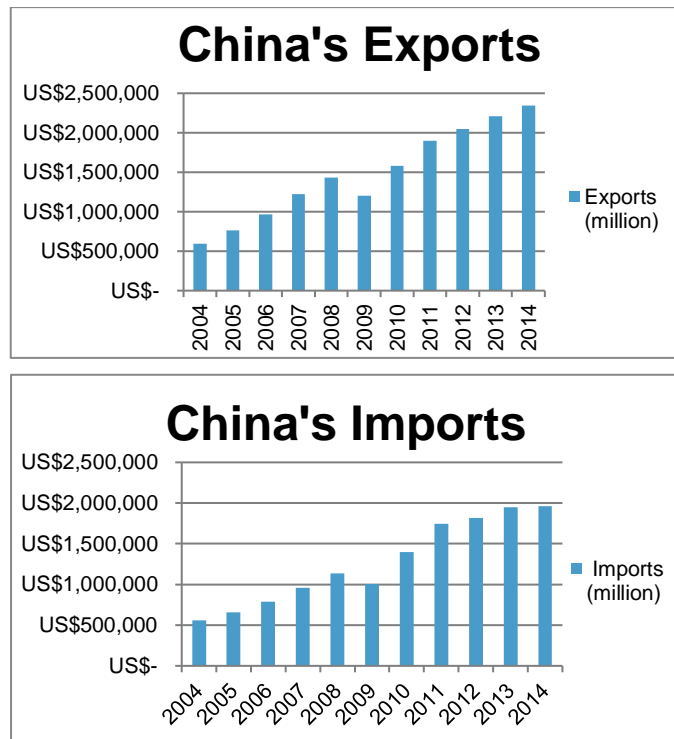
Since the global financial crisis induced by the US subprime mortgage crisis in 2007, the economies in Europe and other world powers have been hit badly, witnessing a declined economic growth. Meanwhile, China's economy was still

seeing a slowdown in its growth. Nevertheless, the sustaining growth of China's economy has laid a good foundation for its economy. In fact, for a country, the currency is the primary international prerequisite for its



economic strength. Frankel (2006) mentioned that both fixed and flexible exchange rates have their own advantages, and a country had the right to choose the regime in accordance with its unique situation. The continuous appreciation of Chinese yuan, which though would make Chinese exports more expensive and thus produce

continuous impacts on the international demand for the domestic products, indicates, from another point of view, that China's imports will be increased. The impact of direct investments on the total international trade is mainly reflected in the complementary effects on trade. Kiyoshi (1973) believed that FDI exerts a complementary effect.



Source: Customs of China

According to Figure 1, which reflects the continuous development of China's export trade, from 2004 to 2014, the total export volume increased from \$593326 to \$2342293 with an average annual growth rate of 17.41%, while the export

share in the international market share and the global ranking had seen greater improvement.

In 2005, the largest sources of imports in China were Japan, EU, South Korea, ASEAN and Taiwan and since 2006, EU



has surpassed the ASEAN, South Korea as well as other regions to become China's second largest source of imports. It could be seen that since 2004, according to the regional distribution of imports, China's five major trade partners have been Hong Kong, EU, ASEAN, South Korea and Japan. The total import trade volume accounted for 55.2 percent of imports, with Hong Kong being its largest trade import partner. Under this international background, Chinese Yuan has become increasingly important in the world. Chinese Yuan

continued appreciating, in the other hand it means that the real effective exchange rate of Chinese yuan is in a continue increasing situation.

Objectives

The research aims to study the impact of macroeconomic factors on China's exports and imports. Particularly, the factors that affect China's exports and imports are REER of yuan, volatility of REER, foreign income, domestic GDP, the industrial production index, tariff as well as the foreign direct investment.

Hypotheses

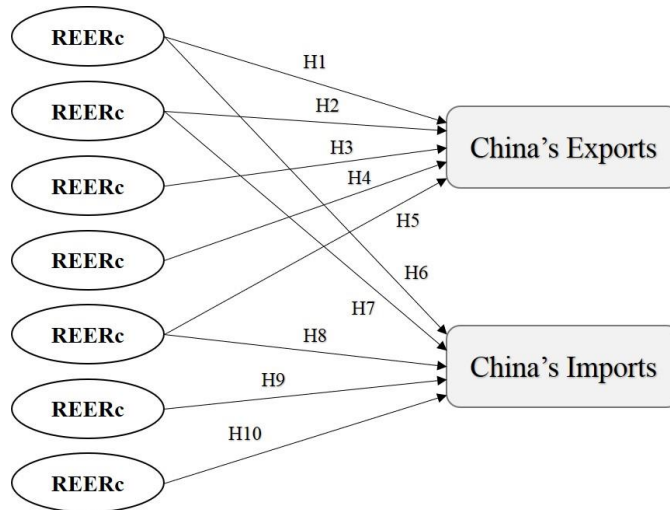


Figure 1 Framework of research

There are ten main hypotheses in my study are as follows:

H1: The real effective exchange rate of China (REERc) has negative impact on exports of China.

H2: The volatility of real effective exchange rate has negative impact on exports of China.

H3: The GDP of World has positive impact on exports of China.

H4: The IPI has positive impact on exports of China.

H5: The foreign direct investment has positive impact on exports of China.

H6: The real effective exchange rate of China (REERc) has negative impact on imports of China.

H7: The volatility of real effective exchange rate has negative impact on imports of China.

H8: The foreign direct investment has positive impact on imports of China.

H9: The domestic GDP has positive impact on imports of China.

H10: The tariff rate has positive impact on imports of China.



Scope of the study

In order to study the factors that determine exports and imports in China, the quarterly time series data of foreign direct investments, industrial production index, real effective exchange rate and volatility of the rate, gross domestic product, foreign income and tariff rate spanning from 2001 to 2014 are utilized. All the original data can be obtained from National Bureau of China, Customs of China, Federal Reserve Economic and Bank for International Settlements (BIS).

Benefits of the study

Based on this research, the relationship between China's exports and imports and macroeconomic factors would be found out through empirical results. The paper will benefit three types of people or organizations. Firstly, this study which provides a deep insight into the factors affecting China's exports and imports will help both the exporters and importers make appropriated decisions based on its conclusion. Secondly, it can prompt policy makers to implement monetary policy according to the changes of the exports and imports as well as exchange rate. Thirdly, it would also be useful to the researchers, export and import managers, and suppliers of exports and imports, including the governments.

Literature review

Many researchers have investigated the factors that affect China's export and import changes, in which the REER,

foreign GDP, domestic GDP and FDI are the main factors that have produced direct effects on exports. As is known to all, when a currency of a country appreciates, its exports will probably reduce. However, with the increase of yuan, China's exports have maintained its growth over the last decade.

Elastic Theory was first proposed by the famous British economist Alfred Marshall (1989) to explain the elasticity of demand. Lal and Lowing (2002), based on VAR model, selected quarterly relevant data of the East Asian countries to find out the J-curve effect with municipal analysis. Hacker and Hatemi-J (2003) pointed out that empirical studies have shown that in some European countries, there is an obvious J-curve effect. Huh Chang-Guk and Zhu Guangyao (2014) who used Johansen's co-integration method in their paper found that Chinese yuan real effective exchange rate (REER) significantly affected Japanese and Korean exports to China. Both two rates appeared to have the opposite sign of the export equation. Kargi (2015) who used the monthly data from 1992-2014, found that according to empirical analysis, there was a very closed long-term relationship between the foreign trade and currency exchange rate in Turkish economy. Greenaway, Kneller and Zhang (2010) found that there had been strong evidence showing that real exchange rate (REER) had a negative effect on the price of goods and services in foreign exports. Huh and Zhu (2014) who studied the real effective exchange rate (REER) and the bilateral real exchange rate (BEER) of Chinese

yuan, held that based on the Johansen's co-integration test, there were evidences showing that the REEF significantly affected Japanese and Korean exports to China.

Asad Abbas, Muhammad Ramzan Sheikh and Muhammad Nauman Abbasi (2015) mentioned that exports sales ratios were affected by firm size, real effective exchange rate and other control variables. Volatility of real effective exchange rate, the ratio of capital employed as well as the world's GDP also served as variables in the analysis model. In his paper, Hway-Boon Ong, et al. (2009) pointed out that Real Gross domestic Product (RGDP) of US and Japan had a positive correlation with exports of Thailand. Thorbecke and Kato (2012) who investigated the effect of exchange rate changes on Germany's exports by using the rest of the world income (WGDP) and REER to test correlation with the Germany's exports, found out that the real exchange rate has a long run equilibrium relationship with Germany's exports. Adewuyi and Akpokodje (2013) explored how the real effective exchange rate volatility affected the economic activities of Africa's sub-groups from the period of 1970 to 2011. Particularly, the growth rate of GDP, money supply and trade openness also have positive impacts on the consumption in international trade. In their study, Suresh and Reddy (2010) used GDP and exchange rate as the independent variables to illustrate the exports of India.

Oshungade (2015) selected 65 countries in his report to analyze the relationship

between GDP, inflation and export and import. And according to this survey, there is Granger causality between inflation, GDP and imports. Besides, imports and exports can also be affected by other multiple variables. Tirmazea and Naveed (2014) indicated that there was a peculiar trend of falling imports to GDP ratio in developing countries.

According to Hsiao (2006) who investigated in his paper the Granger causality relations in east and southeast Asia, FDI and GDP have a very relevant causal relationship in foreign trade.

Sato, Kiyotaka and Zhang (2013) found that in case of the won appreciation, the Korea electric power machinery companies saw a dramatically improved cost competitiveness by producing production at a lower cost while large factories of Japan suffered from the investment management misjudgment caused by excessive production capacity. Katsikea, Theodosiou and Morgan (2007) investigated the relationships between export sales and other variables by collecting data on 164 direct export sales in England. Becchetti and Rossi (2000) also presented an empirical test showing that direct industrial products positively affected exports.

In his paper, Clausen (2003) analyzed the impact of tax influence on trade price and the result indicated that there was a strong and significant relationship between tax rate and the price of import transactions. Besides, nonlinear causality test was used by Karagianny and Saraidaris to investigate the relationship

between taxation and economic growth (2003).

Nicholson (2013) in his paper explored the impact of value added tax (VAT), which refers to the refund of the domestic tax paid by the domestic export enterprises on production of import tax. Santos and Thirlwall (2004) found that a specific tariff led to higher quality and ad-tax usually caused the opposite. Quotas and tariffs dominated the valorem tariff benefits, and imports hampered national welfare to the minimum quality requirements. Macera and Divino (2015) explored how the tariff and exchange rate affect the economy based on the DSGE model. Import tariff serves as a variable that affects the price of imported products. It was found that the exchange rate appreciation could offset the increased initial effects on import tariffs.

Methodology

As a measuring tool, the ordinary least square is usually employed to estimate

the unknown parameter in a regression model. Greenaway, Kaneller and Zhang (2010) investigated the relationship between exchange rate and international trade by using OLS model. There are seven independent variables will be tested whether they impact on China's exports and imports, and the gap of each variables are very big. Therefore, according to the hypothesis and the model of this study, it is appropriate to analyze the relationship between independent variables and dependent variables by OLS.

The result showed that the actual selected variables followed the general form of OLS model between export volume and exchange rate changes. Moreover, due to the negative value of GDP growth rate, the impact of variance could be reduced by just improving the data of exports, imports, FDI, REER, VOL and IPI which are processed with logarithm and the result is just the same. The following are the formulas:

$$\ln X_t = \beta_0 + \beta_1 \ln REER_t + \beta_2 \ln VOL_t + \beta_3 WGDPG_t + \beta_4 \ln FDI_t + \beta_5 \ln IPI_t + e_t \quad (1)$$

$$\ln M_t = \beta_0 + \beta_1 \ln REER_t + \beta_2 \ln VOL_t + \beta_3 GDPG_t + \beta_4 \ln FDI_t + \beta_5 Tariff_t + e_t \quad (2)$$

Where,

$\ln X_t$: Natural logarithm of China's exports at period t

$\ln REER_t$: Natural logarithm of real effective exchange rate of yuan at period t

$\ln VOL_t$: Natural logarithm of volatility of real effective exchange rate at period t

$WGDPG_t$: The foreign income and also using the world's GDP growth rate represent

$GDPG_t$: The domestic GDP growth rate at the year t

$\ln FDI_t$: Natural logarithm of foreign direct investment in China at period t

$\ln IPI_t$: Natural logarithm industrial production index of China

Tariff: The tariff rate of China, e is the random error

e_t : Error term

Results

This study investigates the impact of macroeconomic factors on China's exports and imports by using the

quarterly data during the period of 2001-2014 for all the factors including dependent variables of exports and imports as well as independent variables such as lnREER, lnVOL, WGDGP, GDPG, lnFDI, lnIPI and tariff rate.

Table 1 Unit root test

Variable	ADFtest	t			Prob.	Result
		1%	5%	10%		
lnX	-1.385628	-4.152511	-3.502373	-3.180699	0.8532	No-stationary
D(lnX)	-4.091463	-4.152511	-3.502373	-3.180699	0.0118	Stationary
lnM	-1.186349	-4.140858	-3.496960	-3.177579	0.9030	No-stationary
D(lnM)	-8.724180	-4.140858	-3.496960	-3.177579	0.0000	Stationary
lnFDI	-6.721699	-4.133838	-3.493692	-3.175693	0.0000	Stationary
lnIPI	-4.238274	-4.148465	-3.500495	-3.179617	0.0078	Stationary
GDPG	-2.890334	-3.565430	-2.919952	-2.597905	0.0535	Stationary
lnVOL	-0.364085	-3.555023	-2.915522	-2.595565	0.9077	No-stationary
D(lnVOL)	-8.067648	-3.557472	-2.916566	-2.596116	0.0000	Stationary
lnREER	-1.666901	-4.140858	-3.496960	-3.177579	0.7520	No-stationary
D(lnREER)	-6.497064	-4.140858	-3.496960	-3.177579	0.0000	Stationary
WGDGP	-4.084995	-3.555023	-2.915522	-2.595565	0.0022	Stationary
lnTariff	-5.081535	-4.175640	-3.513075	-3.186854	0.0008	Stationary

Table 1 shows the probability value of such variables as lnX, lnM, lnFDI, GDPG, WGDGP, lnVOL, lnREER,

lnIPI, Tariff according to the results of unit root test, which are stationary and can be used for the test.

Table 2 Descriptive statistics

Variables	Mean	Median	aximum	Minimum	Std. Dev.	Observations
D(LNX)	0.043577	0.068598	0.209092	-0.367329	0.124025	55
D(LNM)	0.040120	0.041144	0.278569	-0.303021	0.098937	55
LNFDI	9.895063	9.940639	10.379940	9.208639	0.351799	55
LNIFI	5.966045	5.944373	6.405724	5.592478	0.243352	55
D(LNREER)	0.004333	0.002024	0.077304	-0.047167	0.026239	55
D(LNVOL)	0.004252	0.006622	0.095486	-0.096961	0.037365	55
WGDPG	1.195654	1.260664	3.546940	-1.586229	1.003621	55
GDPG	4.299553	7.592303	14.506620	-16.875070	10.668850	55
TARIFF	10.405450	9.800000	15.300000	9.800000	1.341837	55

In this paper, the three dependent variables of WGDPG, GDPG and Tariff which are stationary in level, are presented by percentage while the value of exports, imports, FDI, REER index, Volatility and IPI are so large, especially

exports, imports and FDI, that they have to be processed by logarithm. In addition, from ADF unit root test, it could be found that those data were in an orderly stationary sequence.

Table 3 Correlations among independent variables of model 1

	LNFDI	D(LNREER)	D(LNVOL)	WGDPG	LNIFI
LNFDI	1.000000	0.262773	0.262740	-0.044959	0.674360
D(LNREER)	0.262773	1.000000	0.310031	-0.320144	0.319430
D(LNVOL)	0.262740	0.310031	1.000000	-0.290919	0.199898
WGDPG	-0.044959	-0.320144	-0.290919	1.000000	-
LNIFI	0.674360	0.319430	0.199898	-0.126341	1.000000

Table 4 Correlations among independent variables of model 2

	LNFDI	D(LNREER)	D(LNVOL)	GDPG	TARIFF
LNFDI	1.000000	0.262773	0.262740	0.044773	-0.536268
D(LNREER)	0.262773	1.000000	0.310031	-0.312565	-0.182461
D(LNVOL)	0.262740	0.310031	1.000000	-0.015491	-0.139102
GDPG	0.044773	-0.312565	-0.015491	1.000000	0.098097
TARIFF	-0.536268	-0.182461	-0.139102	0.098097	1.000000

Table 3 and table 4 show the result of the analysis of the correlations of all the independent variables by using a correlation matrix. A correlation analysis conducted in this paper found that the value of correlation coefficient which

was less than 0.8, was not above the limit value set of the multicollinearity, suggesting that there was no serious multicollinearity problem with all those independent variables which could be used to run regression.

Table 5 Regression results of model 1

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.191611	0.420213	-0.455985	0.650416
LNFDI	-0.041068	0.086032	-0.477355	0.635232
D(LNREER)	-2.071985	0.608410	-3.405573	0.001326***
D(LNVOL)	-0.191904	0.421700	-0.455073	0.651067
WGDPG	0.036697	0.015474	2.371499	0.021690**
LNPI	0.101822	0.124432	0.818292	0.417152
R-squared		0.363439		
Durbin-Watson stat		2.254633		
F-statistic		5.595235		
Prob (F-statistic)		0.000372***		

Note: *, **, ***= significant at the level of 10%, 5% and 1%.

Real effective exchange rate statistically and significantly determines exports in China at the level of 1%, which can be interpreted by the fact that when real effective exchange rate increase by 1%, China's imports will decrease by 2.071985% and when the former decreases by 1%, the latter will increase by 2.071985%. Foreign gross domestic

product growth rate (WGDPG) statistically and significantly determines China's imports at 1% level, which can be interpreted by the fact that when foreign GDP growth rate increases by 1%, China's imports will increase by 0.036697% and when the former decreases by 1%, China's imports will decrease by 0.036697%.

Table 6 Regression results of model 2

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.009276	0.423869	0.021885	0.982600
LNFDI	0.006187	0.037032	0.167066	0.868000
D(LNREER)	-1.645733	0.454184	-3.623492	0.0007***
D(LNVOL)	-0.532814	0.300463	-1.773308	0.0824*
GDPG	0.002891	0.001052	2.748229	0.0084***
TARIFF	-0.003211	0.009317	-0.344605	0.731900
R-squared		0.454287		
Durbin-Watson stat		1.947962		
F-statistic		8.158173		
Prob(F-statistic)		0.000012***		

Note: *, **, ***= significant at the level of 10%, 5% and 1 %.

The results of exports and imports show that the values of DW equal to 1.509309 and 1.975645 respectively, which are greater than 1.374 and less than 2.232. Hence, there are no auto-correlation problems with both two models.

Conclusion and discussion

The significant factors affecting imports and exports

According to the regression results, three factors including volatility of real effective exchange rate (VOL) and foreign income (WGDPG) affect China's exports. Especially, the foreign income has positive impact on China's exports significantly when it is at the level of 0.05 and the real effective exchange rate has negative impact on China's exports significantly at the level of 0.01, which is why the null hypotheses are accepted. It can be found that three dependent

variables including real effective exchange rate (REER), volatility of real effective exchange rate (VOL) and gross domestic product (GDP) have been related to China's imports. Particularly, real effective exchange rate and volatility had significantly negative correlations with China's imports at level 0.01 and 0.1. Besides, there is a strong positive correlation between gross domestic product and China's imports.

For real effective exchange rate (REER), according to the above empirical results, the real effective exchange rate plays an important role in exports and imports of China. Generally, the real effective exchange rate has a significantly negative effect on foreign trade, which has been proposed by Greenaway, V.Nagi, Reddy (2014) and Antoine Berthou (2008).

For the growth of GDP (GDPG), it has a positive effect on the actual China's import significantly, which is in consistent with literature reviews by



Tirmazea and Naveed (2014). If domestic income increase leads to increased exports, it is feasible for the government to boost the GDP so as to increase exports and reduce the trade surplus.

For the volatility of real effective exchange rate (VOL), it has affected China's imports, and Reza Sirgar and Ramkishen S.Rajan (2004) produced the same result. However, the hypothesis that the volatility of real effective exchange rate impacts China's exports was rejected by the regression test.

The insignificant factors

However, the other three variables, which are volatility of real effective exchange rate, industrial production index and foreign direct investment have no impacts on China's exports, suggesting that the null hypotheses are rejected. In addition, another two variables which are foreign direct investment and tariff rate have no impacts on China's imports either. Moreover, investigation has found that there has been little change in the average tariff rate, suggesting that it is insignificant.

For foreign direct investment (FDI), empirical results show that it has no impact on both China's exports and imports, which rejects the hypotheses. The results seem to be inconsistent with literature reviews, including those made by Singh (2002), Pacheco and López (2005), Galan (2006), Hsiao (2006), Muhammad et al. (2015), Yao (2006),

Mutascu (2011) and so on. In his research, Arshad Muhammad (2012) who studied the FDI influence on trade and economic growth of Pakistan, found that according to the result of the examination of the relationship between FDI and exports, the hypothesis that FDI has produced a significant impact on exports in Pakistan should be rejected. The same result was reached by Chow (2012), who held in his research that there is no significant impact on imports under the fixed effects and random effects models with dummies by regression method of analyzing the relationship between FDI and Korea's imports and exports. In fact, it even has no significant effect on exports and imports in Taiwan.

For the foreign income (WGDP), there is a positively significant relationship between foreign income (WGDP) and exports in China, suggesting that the hypothesis of foreign income affecting China's exports is supported by the regression result. In other words, in China, an increase of foreign income will lead to an increase of exports, which has been proposed by Suresh and Reddy (2010), Tarlok Singh (2004), Adewuyi and Akpokodje (2013), Reddy (2010).

For the volatility of real effective exchange rate (VOL), the result seems to be different from that of other related literatures. It is worth noting that the exchange rate volatility is not totally transferred to the exports price, because exported intermediate goods form constitute only part of the final goods, and the effects of exchange rate fluctuation on the export price, the



wholesale price as well as the retail price are witnessing a gradual decrease.

The result suggests that industrial production index (IPI) has an insignificant correlation with exports in China from the result, which is not consistent with literature reviews. According to the early empirical researches, there was a positive relationship between industrial production index and exports, which had been proposed by researchers such as Becchetti and Rossi (2000). There is a positive but insignificant relationship between industrial production index and exports, and the hypothesis that the industrial production index has an impact on exports of China was rejected by empirical results.

For tariff, the result shows that the hypothesis of tariff is rejected, indicating that tariff has no effect on China's imports. The result seems to be inconsistent is not consistent with literature reviews, but the coefficient is positive in according to the regression result of Model 2, which have been supported by such researchers as Clausing (2003), Karagianny and Saraidaris (2003), Nicholson (2013), Santos and Macera and Divino (2015).

The quarterly data was used to examine in this paper. Therefore, the data of some variables are collected by monthly data, and then the error may occur in the process of converting the data from monthly to quarterly. It is the one of important reason the factors have not consistent with the previous studies in the past.

Implication and recommendation

The results show that such factors as foreign direct investment and tariff rate have no impact on China's exports and imports. In addition, to make more precise and exact research, this study provides some recommendations. Firstly, real effective exchange rate is an import important factor which that has a significant impact on China's exports and imports. After exchange rate reform in China, the exchange rate of yuan fluctuates with higher frequency, which presses domestic enterprises to step in foreign exchange markets with greater threats. With regard to export, in order to achieve higher export competitiveness and diversification, several policies need to be implemented.

Secondly, it is necessary for the government to implement policies to encourage export by, such as exemption of export tax rate, investment incentive. If developing countries want to get rid of poverty, barriers to their exports have to be removed. The availability, capacity and competitiveness of domestic producers should be improved to enhance export performance. Besides, China should also increase necessary imports so as to improve the trade balance by integrating import with the adjustment and upgrading the domestic industries as well as technology imports, in which it is important to further expand the bilateral trade scale and realize trade balance.

Finally, this study applies the OLS model to examine the impact of macroeconomic factors on China's exports and imports.



Given the fact that the real effective exchange rate has a significant effect on China's international trade and the GDP is also an important factor for exports and trade, future researchers can increase investigation in this regard on the basis of the results.

Limitations of the research

After empirical test for this study, there are a lot of macroeconomic factors impact on China's exports and imports, there are some factors which effecting exports and imports might be missed to examine in this research. The quarterly data was used to examine in this paper. If

possible, the monthly data may be used to get more accurate results. The weighted average tariff rate is used to represent dependent variable Tariff to investigate in this study. This paper did not divided sectors to examine how the tariff affects China's imports. The last lamination is the OLS model is used to examine the macroeconomic factors impact on China's exports and imports. Therefore, VAR model and VEC model were extensive using to analysis the factors impact on performance of exports and imports, which means OLS model might not the best econometric method to examine the impact on exports and imports.

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