

Empirical Study of Gravity and Potential of Textile Trade between China and SCO Members

Weiwei Li, Shuangyan Li*

School of Textile, Zhongyuan University of Technology, Zhengzhou, 450007, China

Abstract

This paper explores the factors influencing textile trade between China and SCO member countries in the context of the second expansion of the Shanghai Cooperation Organization (SCO), and on this basis, measures the potential of textile trade between China and SCO member countries in 2021. The results show that the total population, GDP per capita, WTO accession or not, and textile industry competitiveness index of the sample countries have a positive effect on textile trade; while the distance between the two countries has a hindering effect on textile trade. Among the eight sample countries: two countries belong to the "great potential" type, with which China has great room for textile trade; four countries belong to the "potential development" type, with which China can further explore its textile trade potential; two countries China needs to cultivate new elements for the development of textile trade with them.

Keywords

SCO Members; Textile Trade; Trade Gravity; Trade Potential.

1. Introduction of SCO Member States

The Shanghai Cooperation Organization (SCO) originated at the critical moment of the transition from the old to the new international order after the end of the Cold War, and was the first regional multilateral organization created with the participation of China, which played an important leading role. Shanghai Cooperation Organization (SCO), abbreviated as SCO, is an international organization established in Shanghai by China, Russia, Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan. The SCO was born out of the Shanghai Five meeting mechanism established in 1996, and the old name Shanghai Five ceased to apply after Uzbekistan joined in 2001 and was changed to the Shanghai Cooperation Organization, with the founding members being China, Russia, Kazakhstan, Kyrgyzstan, Tajikistan, and Uzbekistan. In 2017, the SCO expanded for the first time with the addition of India and Pakistan. The number of member states increased from 6 to 8. On November 27, 2022 Iran's parliament passed the bill on Iran's membership in the SCO with a high vote. After Iran's accession, the nine member states cover an area of 35.72 million square kilometers, accounting for 27% of the world's 197 countries; the total population of the nine member states is 3.3 billion, accounting for 42% of the global population.

The total trade among SCO member states in 2021 already exceeds \$776 billion, an increase of 25% over 2020; despite the hindrance of the New Crown Pneumonia epidemic, the average annual increase between 2017 and 2021 is 31.5%, illustrating the huge trade potential of the SCO. With the establishment and operation of multilateral trade and financial mechanisms and service platforms such as SCO CUP, SCO Economic and Trade Ministers' Meeting, Eurasian Economic Forum, SCO Economic Forum, SCO International Investment and Trade Fair, etc., and the gradual improvement of multilateral trade rules within SCO, the market space within SCO will be even broader in the future [1].

2. Trade Gravity Model

2.1. Introduction to the Gravitational Model

The traditional gravitational model reveals the gravitational force between two objects, the attraction between two objects is inversely proportional to the distance between them and directly proportional to their masses. The bilateral or multilateral gravitational model of trade assumes that the amount of trade between two countries is inversely proportional to the distance between them and proportional to the total economic volume of the two countries. The traditional trade gravity model is:

$$X_{ij} = \frac{A \times (GDP_i \times GDP_j)}{DIS_{ij}} \quad (1)$$

In equation (1): X_{ij} is the bilateral trade volume between country i (exporter) and country j (importer); A is a constant; GDP_i is the GDP of country i ; GDP_j is the GDP of country j ; DIS_{ij} is the distance between country i and country j , which is generally expressed as the distance between the capitals of the two countries.

Taking the natural logarithm of both sides of equation (2-1) yields:

$$\ln X_{ij} = \alpha_0 + \alpha_1 \ln GDP_i + \alpha_2 \ln GDP_j - \alpha_3 \ln DIS_{ij} + \mu_{ij} \quad (2)$$

2.2. Model Construction

In this paper, we propose to study the gravitational force of textile trade between China and SCO member countries, and based on the purpose of the study and the availability of data for each country, the model is extended on the basis of equations (2-3) as:

$$\ln X_{ij} = \alpha_0 + \alpha_1 \ln DIS_{ij} + \alpha_2 \ln POP_j + \alpha_3 \ln GNI_j + \alpha_4 WTO + \alpha_5 TCI_j + \mu_{ij} \quad (3)$$

In equation (3), the explanatory variable X_i represents the textile trade volume exported from country i to country j and imported from country j in period t ; DIS_{ij} is the spatial distance between country i and country j . Since the distance does not directly reflect the convenience of transportation or not, it is expressed as the straight-line distance between the two capitals divided by the international oil price; POP_j is the total population of country j ; GNI_j is the per capita domestic ; WTO represents whether country j is a member of the World Trade Organization; TCI_j is the competitiveness index of textile industry in country j ; α_0 is a constant term, α_k is the regression coefficient of each variable ($k=1,2,3 \dots .5$), and μ_{ij} is the random variable.

The sample countries are selected from eight other SCO member countries except China, namely Russia, Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan, India, Pakistan, and Iran. The panel data of these countries from 2010-2021 are selected for the study.

2.3. Indicators Selection

In this paper, the total import and export of textiles (abbreviated as X in US dollars) between China and eight SCO member countries is selected as the explanatory variable, which can reflect the size of China's textile trade with SCO member countries, and the main factors affecting this indicator and its future development prospects are studied. The data are obtained from the United Nations trade database UNCOMTRADE (<https://comtradeplus.un.org/>) for textiles

under SITC65, and are calculated by taking the current price in US dollars as the unit of measurement.

Explanatory variables:

(1) Spatial distance (abbreviated as DIS) is the underlying variable that affects transaction costs. The direct impact of spatial distance on transaction costs is reflected in transportation costs, and if the distance is relatively close, it can significantly reduce transportation costs and have a significant impact on the scale of bilateral trade between the two countries. Bian Fukun believes that the spatial distance variable is fixed by the location of the distance between the two capitals as an indicator. In order to eliminate the covariance problem in the data operation process, the actual distance divided by the international oil price is used to express the geographical distance in the operation process, which can eliminate the covariance problem and can better reflect the trade cost problem between the trading countries[2]. The distance data between Beijing, the capital of China, and the capitals of each trading country are obtained from the "Straight-line distance from Beijing to the capitals of each country in the world", and the international oil price data are obtained from the US stocks in the past years.

(2) The total population of the trading country (abbreviated as POP), the population size of the trading country determines the number and quality of laborers, which on the one hand can reduce costs and produce sufficient goods, and on the other hand, a large population can create economic value, which is conducive to imports and increases trade dynamics. The population size of the importing country can reflect the market size and consumption level, the larger the population, the larger the market, the more goods and materials need to be imported, which will promote the import level to a certain extent. The data is obtained from the World Bank database (<https://data.worldbank.org/>).

(3) The GDP per capita of the trading country (abbreviated as GNI, unit: USD), GDP per capita is an important indicator to measure the demand of a country, and a larger GDP per capita of a country indicates that the demand potential of the country is also larger, and it is calculated by taking the current price of USD as the unit of measurement. The data is obtained from the World Bank database (<https://data.worldbank.org/>).

(4) Whether the trading country is a member of the World Trade Organization is a dummy variable (abbreviated as WTO). The World Trade Organization is an international organization established by the United Nations to promote trade between countries and enhance trade facilitation, and becoming a member of the WTO will enable the country to enjoy the policies of the organization in many aspects, if the country is a member of the WTO, the value of the indicator will be defined as 1, and if it is not a member of the WTO, the indicator will be defined as 0. The initial value is used directly in the empirical analysis.

(5) Textile Industry Competitiveness Indexes (Trade Competitiveness Indexes, abbreviated as TCI, dimensionless indicators), which can measure a country's position and role in the development of the world textile industry, refers to the ratio of the import and export balance of textiles and clothing to the total import and export of all commodities. The value of the textile industry competitiveness index usually lies between -1 and 1, with values greater than 0 indicating that the country is a net exporter of textiles and less than 0 indicating that the country is a net importer of textiles[3]. The data of textile exports and imports of trading countries and total imports and exports of all commodities are obtained from the World Trade Organization database (<https://data.wto.org/en>), and the textile industry competitiveness index is calculated by the author based on the textile exports and imports of trading countries and total imports and exports.

Since the trade volume differs among countries, a direct regression using Xij values would cause the data series to be unstable and affect the final estimation results, so logarithmic treatment is

performed in the panel data regression. The theoretical explanations, expected signs, and data sources of the explanatory variables are shown in Table 1.

Table 1. Explanatory variables description

Variable Name	Expected symbols	Theoretical description	Data source
lnDIS _{ij}	-	The distance between country i and country j, expressed as the straight-line distance between the two capitals divided by the international oil price, the larger the value, the greater the trade communication and transportation costs, hindering textile trade.	Straight line distance from Beijing to the world's capitals US stocks
lnPOP _j	+	The total population of country j. A larger population can create more economic value, and the larger the population, the larger the market, and the more goods and materials need to be imported to promote textile trade.	World bank open data
lnGNI _j	+	GDP per capita in country j, which indicates the textile consumption capacity of country j. The larger the value, the larger the import of textiles.	World bank open data
WTO	+	The dummy variable, if country j joins the World Trade Organization, i.e., represents belonging to the same organization as China, enables trade facilitation and liberalization between the two countries and promotes textile trade.	World Trade Organization official website
TCI _j	+	The competitiveness index of textile industry in country j, greater than 0 means that the country is a net textile exporter and less than 0 means that the country is a net textile importer.	World Trade Organization Database

3. Empirical Study of Trade Gravity and Potential

3.1. Trade Gravity

Table 2. Regression results of the 3 effects of POLS, FE, and RE

	POLS	RE	FE
	model1	model2	model3
lnDIS _{ij}	-0.546*** (0.160)	-0.546*** (0.160)	-0.813* (0.414)
lnPOP _j	0.375*** (0.040)	0.375*** (0.040)	0.384*** (0.044)
lnGNI _j	0.150** (0.066)	0.150** (0.066)	0.166** (0.079)
WTO	0.533*** (0.134)	0.533*** (0.134)	0.479*** (0.154)
TCI	2.989* (1.775)	2.989* (1.775)	2.807 (1.887)
constant term (math.)	14.943*** (0.928)	14.943*** (0.928)	15.818*** (1.467)
N	83	83	83
R2	0.702		0.643

* p < 0.1, ** p < 0.05, *** p < 0.01.

Note: t-test values in parentheses; *** indicates passing t-test at 1% significance level, ** indicates passing t-test at 5% significance level, * indicates passing t-test at 10% significance level.

According to the sample data, in order to take into account the estimation efficiency and robustness of the model, the regression results of three effects, POLS (mixed effects), RE (random effects) and FE (fixed effects), are selected in this paper, and the results of model 1, model 2 and model 3 are extended regressions as shown in Table 2.

According to the regression results in Table 2, the optimal model 1, i.e., the mixed-effects regression, is selected as the final explanatory model. In model 1, spatial distance of trading countries, total population, GDP per capita, WTO accession or not, and textile industry competitiveness index all have effects on China's textile export trade gravity, but there are differences among the influencing factors. Specifically, the bilateral spatial distance, total population, and WTO accession pass the test at 1% significance level; the GDP per capita passes the test at 5% significance level; and the textile industry competitiveness index passes the test at 10% significance level, with the following results.

The coefficient of spatial distance of trading countries is -0.546 and is highly significant with the same sign as the predicted sign, which is an important factor inhibiting China's textile trade with SCO member countries. Other things being equal, for every 1% increase in spatial distance between China and SCO member countries, China's textile trade with SCO member countries will shrink by 0.546%.

The coefficient of the total population size of trading countries is 0.375 and highly significant, with the same sign as the predicted sign, which is an important factor in promoting textile trade between China and SCO member countries. All other things being equal, for every 1% increase in the total population size of China and SCO member countries, China's textile trade with SCO member countries will expand by 0.375%.

The coefficient of GDP per capita of trading countries is 0.150 and significant with the same sign as the predicted sign, which is an important factor in promoting textile trade between China and SCO member countries. Other things being equal, for every 1% increase in GDP per capita of China and SCO member countries, China's textile trade with SCO member countries will expand by 0.150%.

The coefficient of the dummy variable of whether the member countries join WTO is 0.533 and is highly significant. The accession of SCO member countries to WTO can further reduce trade barriers and help Chinese textile exports.

The coefficient of textile industry competitiveness index of trading countries is 2.989 and significant, and its sign is the same as the predicted sign, which is an important factor in promoting textile trade between China and SCO member countries. All other things being equal, for every 1% increase in the competitiveness index of textile industry between China and SCO member countries, the textile trade between China and SCO member countries will expand by 2.989%.

Based on the regression results of the above gravity model of China's textile trade with other SCO member states (Model 1 in Table 2), the equation for the theoretical export value of Chinese textiles to other SCO member states is constructed as equation (4):

$$\ln X_{ij} = 14.943 - 0.546 \ln DIS_{ij} + 0.375 \ln POP_j + 0.150 \ln GNI_j + 0.533WTO + 2.989TCI_j \quad (4)$$

3.2. Trade Potential

Combined with equation (4) to calculate the theoretical value of China's textile trade with SCO member countries in 2021, the trade potential of China with each SCO member country is collated and calculated by the ratio of actual trade volume to theoretical trade volume, as shown in Table 3.

Table 3. China's textile trade potential and types with SCO member states in 2021

Country	Actual total import and export value(X1)/billions of dollars	Forecasted total import and export value(X2)/billions of dollars	Trade Potential (X1/X2)	Trade Type
Russia	24.39	19.60	1.24	Potential re-styling
Kazakhstan	10.40	11.48	0.91	Potential development
Kyrgyzstan	5.05	5.00	1.01	Potential development
Tajikistan	1.72	5.94	0.29	High potential
Uzbekistan	14.26	7.47	1.91	Potential re-styling
India	56.26	48.31	1.16	Potential development
Pakistan	38.75	27.08	1.43	Potential development
Iran	5.53	8.30	0.67	High potential

According to the ratio of actual trade volume to theoretical trade volume, the trading partners are divided into three types: when the ratio of actual trade volume to theoretical trade volume is less than 0.8, it is the type with High potential, it has not yet shown its potential trade potential, and there are greater trade opportunities; when the ratio of actual trade volume to theoretical trade volume is 0.8 to 1.2, it is the type with Potential development, the trade potential can still be improved; when the ratio of actual trade volume to theoretical trade volume is greater than 1.2, it is the type with Potential re-styling, the trade potential has been fully shown, and new trade growth points must be re-established. When the ratio of actual trade volume to theoretical trade volume is greater than 1.2, it is potential reshaping, i.e., the trade potential has been fully revealed, and new trade growth points must be re-established[4].

As seen in Table 3, among the eight sample countries, two countries are "high potential" countries, four countries are "open potential" countries, and two countries are "reshaped potential" countries. The "potential reshape" countries.

Specifically, the two "huge potential" countries are Tajikistan and Iran. China's textile trade with the above two countries is still far from enough, trade potential has not been fully developed, need to further increase the import and export trade of textiles to the above countries. We should fully explore the market of these countries, with the gradual improvement of SCO commodity tariffs, in the near future, countries actively seek trade cooperation, mutual benefit and win-win, in the future will certainly be able to harvest a brighter market prospects. The four "potential" countries are Kazakhstan, Kyrgyzstan, India and Pakistan. China's textile trade with these countries has reached the basic degree of saturation, but there is still some room to continue to maintain and actively develop new trade elements, also indicates that the textile market needs to further broaden, and actively seek new growth points for textile trade in these countries, and actively play the law of market development, to develop the potential of these markets.

Two "potential re-shaped" countries for Russia, Uzbekistan. China and the above two countries have been given full play to the potential of textile trade, can cultivate the development of new elements of textile trade, and actively looking for trade growth points, to stimulate the secondary trade with Russia and Uzbekistan vitality, and promote the development of both sides.

4. Conclusion

(1) Geographical distance, population size, GDP per capita, WTO accession or not, and textile industry competitiveness index factors all affect China's textile exports to these countries to different degrees. First, the spatial distance barrier is still a factor inhibiting China's textile trade to SCO member countries. For every 1% increase in spatial distance between China and SCO member countries, the textile trade between China and SCO member countries will shrink by 0.546%; the total population of the trading countries has a positive contribution to the textile trade between China and SCO member countries, and for every 1% increase in the total population of China and SCO member countries, the textile trade between China and SCO member countries will expand by 0.375%; The GDP per capita of trading countries has a positive impact on textile trade, and for every 1% increase in GDP per capita, textile trade will expand by 0.150%; the coefficient of the dummy variable of whether the member countries join WTO is 0.533, and the accession of SCO member countries to WTO can further reduce trade barriers and help China's textile import and export trade. The competitiveness index of textile industry has a positive influence, for every 1% increase in the competitiveness index of textile industry between China and SCO member countries, the textile import and export volume between China and SCO member countries will expand by 2.989%.

(2) In terms of economic influencing factors, both China's GDP per capita and the GDP per capita of SCO member countries have a significant positive impact on China's textile trade. However, the influence factor of China's GDP per capita is far less deep than that of the GDP per capita of the SCO member countries. This indirectly indicates that China's textile exports to the SCO member states are demand-based rather than supply-based, i.e., the demand of the target countries is the main factor influencing textile exports.

(3) In China's textile trade with SCO member countries, the trade potential of 75% of the countries has not been fully developed, such as Kazakhstan, Kyrgyzstan, Tajikistan, India, Pakistan and Iran need to further remove trade barriers, actively seek the characteristics of textile trade in these countries, analyze the law of market development, go to actively explore the potential of these markets, mutual benefit and win-win, in The future will certainly reap a brighter market prospects. For some countries such as Russia, Uzbekistan's textile trade potential has been given full play, the need to dig and cultivate new trade promotion factors, and actively seek trade innovation points to stimulate the vitality of China's textile trade with Russia, Uzbekistan.

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