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ANALYZES WITH AN INTERESTING GRAVITY MODEL WHAT AFFECTS RELATIONSHIP BETWEEN CHINA AND ITS MAIN TRADING PARTNERS IN THE COTTON TRADE

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Abstract

This study employs the gravity model approach to investigate the factors that affect the relationship between China and its main trading partners in the cotton trade from 2000 to 2017 with a total of 18 selected importing partners. The major objective of this paper is to identify some of the determinants of China's cotton exports to its top 18 trading partners. The empirical estimates reveal that among the control variables in the gravity equation, the exchange rate has a significant positive impact on China's cotton exports, which suggests that cotton exports increase with depreciation in the Chinese Yuan along with the currencies of the partner countries. Tariffs have negative robust effects on Chinese cotton exports, which indicates that a high tariff rate of the partner countries will lower the exports of cotton from China. Furthermore, the traditional variable of distance has a negative effect on Chinese cotton exports, which indicates that the cost of transport depends on the distance; thus, the export of cotton decreases as the distance increases. Finally, an increase in both China's GDP and an importer's GDP along with population has a significant positive effect on China's cotton exports. The results of this study will be helpful to the Chinese government in setting cotton export policies.

JEL CLASSIFICATION: F00; F10; F14; F41; F47

KEYWORDS: COTTON EXPORTS; GRAVITY MODEL; POISSON REGRESSION; AVERAGE MARGINAL EFFECTS; CHINA

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1. Introduction

Rapid economic growth and exports are widely regarded as the most significant and imperative goals of developing countries. Both classical and neoclassical economists have studied foreign trade as the catalyst for an economy's development (Atif, Haiyun, and Mahmood, 2016). The export-led growth hypothesis in particular urges developing economies to increase exports to gain further development (Barro, 1991). Keeping in mind the importance of exports, the factors that determine and explain export flows have been broadly examined and reviewed by both policy-makers and academics. Worldwide, nearly 250 million people are dependent on cotton production and processing for their livelihoods, and a significant number of people work in the cotton industry. It is one of the world's largest fibre and cash crops (Better Cotton GIF, 2017-18). China is an emerging economy, and similar to other economies, China is also witnessing faster economic growth because of the country's latent trade capacity and, in particular, the cotton trade. In some nations, the cotton trade contributes to as much as 40 percent of exports of products and more than 5% of GDP (Baffes, 2005). In several regions, cotton is the backbone of agricultural commodities, supports a broad rural population and supplies significant raw material to the textile industry. In China, cotton is one of the most valuable cash crops relative to other crops. With more than 10 million workers, the Chinese cotton textile industry is the largest sector in the country, while the country's most important export commodities are textiles and garments (UNEP, 2002). The accession of China to the WTO gives the textile industry a favourable opportunity; however, it can have a major effect on cotton production (UNEP, 2002).

India was the largest producer of cotton in the world from 2017-2018, while China was the second-largest cotton producer worldwide. Cotton production was estimated at 27.5 million bales in China in 2017 and 2018, which was 21 percent higher than in the previous year. After almost a decade of decline in the eastern areas where cotton crops are grown, production appears to have stabilized, while higher areas and yields in the Xinjiang region push production to record levels. The cultivated area of China for 2017-2018 was estimated at 3.4 million hectares, which was 500,000 hectares over that for 2016-2017, while the production is projected at 1,761 kg/hectare, which is 3.1% higher than the previous season (Johnson et al., 2018, United States Department of Agriculture [USDA], 2018). Furthermore, the overall area cultivated for cotton crops in 2018-2019 dropped by 3.1 percent to 3.25

million hectares from the estimated 3.35 million hectares in the previous year. The decrease in the overall area planted in 2018-2019 was a consequence of sluggish cotton earnings and higher corn prices in 2017-2018 in some regions where farmers can easily replace corn with cotton (USDA, 2018). Global cotton production in the 2018 marketing year dropped by 3 percent to 25.8 million tons (Mt). In India, China, and the United States, declines in cotton production were observed, while only Brazil increased its output. Pest issues, bad weather, and limited water supply were the main reasons that led to declines in cotton production in 2018. In 2018, global consumption of cotton rose by 2 percent to 27.3 million tons (Mt). China continued to remain the world's largest raw cotton user and accounted for approximately one-third of the total use of spinning mills, followed by India. Cotton exports rose globally from 7 percent to 9.5 Mt or 37 percent of world production (OECD-FAO Agricultural Outlook 2019-2028).

Although China is the world's second-largest cotton producer, China is the third-largest cotton importing country, and it imports 13 percent of the cotton traded globally. Until 2016, China had been the largest trade partner for cotton with the United States; however, in 2016, Vietnam became the largest trading partner for U.S. cotton, and China became the second-largest trading partner (USDA, 2018c). In 2017, the United States exported approximately 16 percent of its cotton to China. Last year, China imported cotton worth approximately $976 million from the U.S., which is the second-highest of all other row crops after soybeans. Considering the overall domestic use of cotton in China, exports of cotton from China are negligible, at approximately 10,000 tons per year (USDA, 2018). Due to high stocks in China, in 2016 and beyond, the country's cotton exports were expected to increase further with the importing countries on the expectation that the Chinese government wants to sell its stock at a price that is more market-oriented (USDA, 2016). The cotton exports hit the highest level in nine years at 28,000 tons in 2015-2016, while in 2016-2017, cotton exports remained at 13,000 tons. According to the USDA post projections, cotton exports amounted to 22,000 tons in 2017-2018 and were further expected to slip to 13,000 tons in 2018-2019 (USDA, 2018).

China's trade flow has attracted some attention from previous researchers such as Dadakas et al. (2020), Kea et al. (2019), Rahman, Shahriar, and Kea (2019), Lateef, Tong, and Riaz (2018), Kabaklarli, Duran, and Ucler (2018), and Monineath (2018). However, no study can be found in the literature that analyses China's bilateral cotton trade with 18 major trading partners by using a gravity model approach. The key purpose of this research is to identify the determinants of Chinese cotton exports for the period of 2000-2017. This study uses the gravity model for its empirical analysis and verification to determine whether China's bilateral trade can be explained by economic indicators such as GDP, the GDP per capita of reporting and partner countries, distance, exchange rate, population, common border, and free trade agreements (FTAs). To the best of our knowledge, no earlier study in the literature review attempted to identify the determinants of Chinese cotton exports by using the gravity model approach. The goal of this study is to fill the literature gap on the determinants of cotton exports in China that will enable policy-makers to formulate cotton export policies in the country.

2. Literature review

Many researchers have used the gravity model to analyse export determinants for a particular commodity. To analyse the relationship between China and 23 Asia and Pacific countries between 1992 and 2000, Abraham and Van Hove (2005) used a gravity model. Their empirical findings showed that China's regional agreement participation has great export potential and minor impacts on Asia-Pacific exports from ASEAN and APEC. For Xinjiang's bilateral trade, Xuegang et al. (2008) used the three explanatory variables of GDP, GDP per capita, and the Shanghai Cooperation Organization (SCO). Their outcome showed that Xinjing's bilateral trade was influenced by all three variables. Sevela (2002) used a gravity model to examine the relevant determinants for the Czech Republic's agricultural exports. The study concluded that agricultural exports are closely linked to gross national income (GNI) and that distance is harming agricultural exports.

As the world's largest producer and exporter of textile products since 2000, the determinants of Chinese textile exports were studied with data from 1985 to 2004 by Chan and Au (2007). The results indicated that for China's textile exports, the real exchange rate, GDP, FTA membership, per-capita GDP, and importers' population growth are all statistically significant. Geographical distance, in contrast, has no significant effect on the textile trade. The trade flows between China and its major trade partners in Asia, North America, and Europe were also studied by Caporale et al. (2015) by using a panel data approach over the period of 1992 to 2012. The findings of the study confirmed that China's trade structure had changed considerably in connection with rapid external trade growth.

Using the gravity model, Hatab, Romstad, and Huo (2010) investigated the key determinants of Egyptian agricultural exports to its major trading partners by using data for the 1994-2008 period. Their results showed that a one-percent increase in Egypt's GDP results in roughly a 5.42-percent increase in Egypt's agricultural export flows. The exchange rate volatility has a significant positive coefficient, which shows that depreciation in the Egyptian pound against the currencies of its partners stimulates agricultural exports. Distance and transportation costs are found to have a negative influence on agricultural exports.

To explore the driving forces behind China's remarkable export growth, particularly to the United States and Japan, Chen, Rau, and Chiu (2011) used quarterly panel data on 71 industries from 1999 to 2007 to estimate China's exports. For example, an appreciation of Rimini's (RMB) real exchange rate tends to adversely affect Chinese exports to the two countries. However, because of China's higher reliance on Japan's intermediate products, the effect is much greater on Sino-U.S. trade than on Sino-Japanese trade. The study concluded that the empirical evidence also showed that income elasticities and economic growth rate differences could account for China's export growth to the United States more quickly than to Japan.

he determinants of Vietnam's rice exports to Asian and non-Asian nations were examined by Thi and Doan (2013). They used Vietnam's 2010 rice export data and its 124 destination markets. High farm income in importing countries does not inherently contribute to higher exports of rice, although densely populated countries prefer to export higher amounts of rice. In deciding the export trend of firms that operate in one market, value-added agriculture performs better. In particular, distance encourages rice exports in some cases if the destination markets are non-Asian countries, which suggests a high export potential for rice firms. The scholars concluded that the impact of landlocked dummies on heavy bulk products such as rice is much more sensitive to the export volume of rice than to the export value.

The determinants of agricultural exports from Pakistan were examined by Rao, Haiyun, and Mahmood (2016) with the stochastic frontier gravity model by using annual data for the period of 1995 to 2014 and a sample of 63 countries. According to them, the key objective of developed countries is fast economic growth, and exports are considered a motor for economic growth. Their findings showed that both bilateral exchanges and tariff rates also influence exports of agricultural products. The effects of shared boundaries, a common culture, a colonial history, and preferential trade agreements have also been examined, and the study confirmed the significance of each aspect, except for a common language. The technological efficiency figures indicate that with neighbouring, Middle Eastern, and European countries, Pakistan has great export potential.

Lateef, Tong, and Riaz (2018) estimated the impact of the Free Trade Agreement (CPFTA) on agricultural trade in China and Pakistan by using the Poisson Pseudo Maximum-Likelihood (PPML) technique of the gravity model. They used two-panel datasets of agricultural exports for both countries that contain agricultural exports and other macroeconomic variables for China and Pakistan with 110 partner countries from 2001 to 2014. Their findings showed that the CPFTA has a strong trade-creating impact on agricultural exports and helps to exponentially increase Pakistan's agricultural exports to China. However, for Chinese agriculture exports to Pakistan, the CPFTA was found to be ineffective.

For the period of 1990 to 2017, Rahman, Shahriar, and Kea (2019) used data from 40 trading partners and examined export determinants and the issues that affect Bangladesh's textile and apparel exports. They used the gravity model for their analysis. Their findings showed that GDP, GDP per capita, and real exchange rates tend to be major determinants of Bangladesh's export trade in textiles. The findings also revealed that distance has no strong influence on the textile trade. The study found that the two most important export destinations for Bangladesh clothing are the European Union and North American countries with an FTA with the region.

Given the recent shifts in the structure of the economy and the importance of trade for the United Arab Emirates (UAE) economy, Dadakas, Kor, and Fargher (2020) examined the prospects for the country to further expand trade. To analyse the determinants of trade and trade potential, a gravity equation was used on 2002-2016 panel data and a Poisson pseudo maximum probability estimator. The findings indicated that with some of its main trading partners, including some GCC and PAFTA member countries, the UAE has exhausted its trading potential. However, with many other nations, including Japan and India, there is potential for an expansion of trade, which may dictate future trade policy initiatives. Table 1 provides a summary of the previous empirical studies on the determinants of exports.

Table 1. Previous studies on the determinants of exports

Author (s)	Country (s), Time Periods	Estimator (s)	Response Variable	Regressors	Findings
Hatab, Romstad and Huo (2010)	Egypt 1994-2008	Gravity Model	Agriculture exports	Exchange Rate, Egypt's GDP, Distance	Exchange Rate (+) Egypt's GDP (+) Distance (-)
Atif, Haiyun and Mahmood (2016)	Pakistan 1995-2014	Stochastic Frontier Gravity Model	Agriculture Exports	Exchange Rate, Common Border, Tariff	Exchange Rate (+) Common Border (+) Tariffs (-)
Chan and Au (2007)	China 1985-2004	Gravity Model	Textiles Exports	GDP, Real Exchange Rate, FTA	Real Exchange Rate (+) GDP (+) FTA (+)
Otsuki and Majumdsar (2003)	Industrialized and advanced countries	Gravity Model	Beef Exports	Income, Population, Distance	Income (+) Population (-) Distance (-)
Kabaklarli, Duran and Ucler (2018)	OECD Countries 1989-2015	Panel Cointegration	High-Technology Exports	GDP, FDI	GDP (-) FDI (+)
Bhavan (2016)	Sri Lanka 1980-2013	Johansen cointegration, Vector Error Correction Method (VECM)	Sri Lanka Exports	FDI, Interest Payment on Foreign Debt, Import, Gross Capital Formation, Per Capita Income	FDI (-) Payment on Foreign Debt (-) Import (-) Gross Capital Formation (+) Per Capita Income (+)

Table 1. Previous studies on the determinants of exports (continued)

Author (s)	Country (s), Time Periods	Estimator (s)	Response Variable	Regressors	Findings
Magombo, Edriss and Phiri (2017)	Malawi 2001-2013	Gravity Model	Malawi's Cotton Exports	GDP Per Capita Partner, GDP Per Capita Malawi, Exchange Rate, Distance	GDP Per Capita Partner (-) Per Capita Malawi (+) Exchange Rate (+) Distance (-)
Monineath (2018)	Cambodia 1993-2015	Autoregressive Distributed Lag (ARDL) Model	Cambodia Exports	Inflation, Real Exchange Rate, Trade Liberalization, Official Development Assistance	Inflation (-) Trade Liberalization (+) Official Development Assistance (+)
Chan, E.M.H., KF. In addition, M.K. Sarkar (2008)	India 1985-2005		India's Textile Exports	GDP, Real Exchange Rate	GDP (+) Real Exchange Rate (+)
Huong, Ha, and Lan (2017)	Vietnam 2012-2014	Gravity Model	Vietnamese Textile Exports	Transport Cost, Real Exchange Rate, Distance, Tariffs	Distance (-) Real Exchange Rate (+) Tariffs (-)

3. Data and Methodology

3.1 Data

The sample size of this analysis consists of 18 major cotton-importing countries from China. These 18 countries are considered the major trading partners in terms of cotton imports from China for the period of 2000 to 2017, which is divided into the six intervals of 2000 to 2005, 2006 to 2011, and 2012 to 2017. The data on GDP, the real exchange rate, and tariffs are taken from the World Development Indicators (WDI). The cotton data are obtained from the UN COMTRADE database, distance data (in km) are obtained from the CEPII database, and the common borders are collected from the WTO.

3.2 Econometric methodology

This study uses the gravity model to evaluate the flow of cotton from China to its partner countries. The gravity model, which was originally derived from Newton's physics gravity equation, is widely used by researchers to explain international trade. The trade gravity model and its theoretical dimensions have recently been studied elsewhere (Anderson, 1979; Anderson, 2011; Shahriar et al., 2019; Rahman et al., 2019). Tinbergen (1962), Poyhonen (1963) and Pulliainen (1963) simultaneously developed this model as one of the most successful in formulating and clarifying bilateral trade flows. The basic gravity model explicitly states that trade between two countries is determined positively by the GDP of each country and negatively by the distance between them. The formulation can be generalized as follows:

$$X_{ij} = \beta_0 Y_i^{\beta 1} Y_j^{\beta 2} D_{ij}^{\beta 3} \qquad [1]$$

where $\boldsymbol{X_{ij}}$ is the flow of exports between country $\boldsymbol{j}$ and country $\boldsymbol{i}$, $\boldsymbol{Y_{ij}}$ are country $\boldsymbol{i}$ and nation $\boldsymbol{j}$ GDP and D_{ij} **ij** is the distance between the nations' capitals. The linear form of the gravity model is given as follows:

$$\log(X_{ij}) = \alpha + \beta_1 \log(Y_i) + \beta_2 \log(Y_j) + \beta_3 \log(Y_{ij}) \qquad [2]$$

The generalized gravity model of trade states that the volume of exports between pairs of countries, $\boldsymbol{X_{ij}}$**,** is a function of their incomes (GDPs), their populations, their distance, and a set of dummy variables that either facilitate or restrict trade between pairs of countries, which is given as follows:

$$X_{ij} = \beta_0 Y_i^{\beta 1} Y_j^{\beta 2} L_i^{\beta 3} L_j^{\beta 4} D_{ij}^{\beta 5} A_{ij}^{\beta 6} eu^{ij} \qquad [3]$$

where Y_i (Y_j) represents the GDP of the nation i (j), $Li(Lj)$ is the population of country i (j), D_{ij} represents the distance between the two nations' capitals, A_{ij} indicates dummy variables, eu^{ij} is the error term of the model and β is the parameters of the model.

The model that we create is centred explicitly around China's cotton exports. Therefore, it is important to consider the geological structure of China's cotton exports, as represented previously. Cortes (2007) pointed out that the basic formulation of the chosen gravity equation can be strengthened by adding additional variables, whereas this inclusion of variables gives us the possibility of adopting the gravity model in the specific circumstances of the bilateral trade under review. In this way, as explanatory variables, we add some additional factors to better explain China's cotton export flow.

Income is one of the most important factors for trade between two nations, with GDP having the highest possible proportion of the nation's potential trade. The GDP of the trading nation (China) measures productive capability, while the GDP of the importing nation estimates the absorptive limit. These two factors must be positively identified with trade (Kalbasi, 2001). This study likewise included the factors of GDP per capita of importing countries and China. It is normal that when the per capita income of country j is higher, the demand for imports is higher.

This model uses the variable distance as an intermediary of transactivity costs, including transport costs. The most prominent outright geological separation variable is the distance between capitals as an intermediary for the economic focal point of a nation. An expansion in the distance between nations is relied on to build transport costs, which accordingly decreases trade. This variable will have a negative sign (Kristjansdottir, 2005). Proenca et al. (2002) included the real bilateral exchange rate in their observational model as a logical variable for Mercosur-EU trade streams. The coefficient of the real bilateral exchange rate is assumed to be negative. This research presents the dummy variable of common borders. Therefore, the value of cotton exports (X_{ij}) from China i to its major trading partner j is defined as follows:

$$X_{ij=\beta_0} Y_i^{\beta 1} Y_j^{\beta 2} L_i^{\beta 3} L_j^{\beta 4} P_i^{\beta 5} P_j^{\beta 6} T_j^{\beta 7} Exr_{ij}^{\beta 8} D_{ij}^{\beta 9} B_{ij}^{\beta 10} C_{ij}^{\beta 11} R_{ij}^{\beta 12} eu^{ij} \qquad [4]$$

where $\boldsymbol{\beta_0}$ is a constant, $\boldsymbol{Y}$ represents GDP, $\boldsymbol{L}$ is the population, P is the GDP per capita, $\boldsymbol{Exr}$ is the exchange rate, $\boldsymbol{D}$ represents the distance, $\boldsymbol{B}$ is dummy variables of the common border, $\boldsymbol{C}$ is the common language and $\boldsymbol{R}$ **is** the regional trade agreement. For the panel data estimation, this model is recomposed as the accompanying log-linear equation as follows:

$$(X_{ij}) = \beta_0 + \beta_1(Y_i) + \beta_2(Y_j) + +\beta_5(P_i) + \beta_6(P_j) + \beta_7(T_j) + \beta_8(Erx_{ij}) + \beta_9(D_{ij}) + \beta_{10}(B_{ij}) + \beta_{11}(C_{ij}) + \beta_{12}(R_{ij}) + eu_{ij} \qquad [5]$$

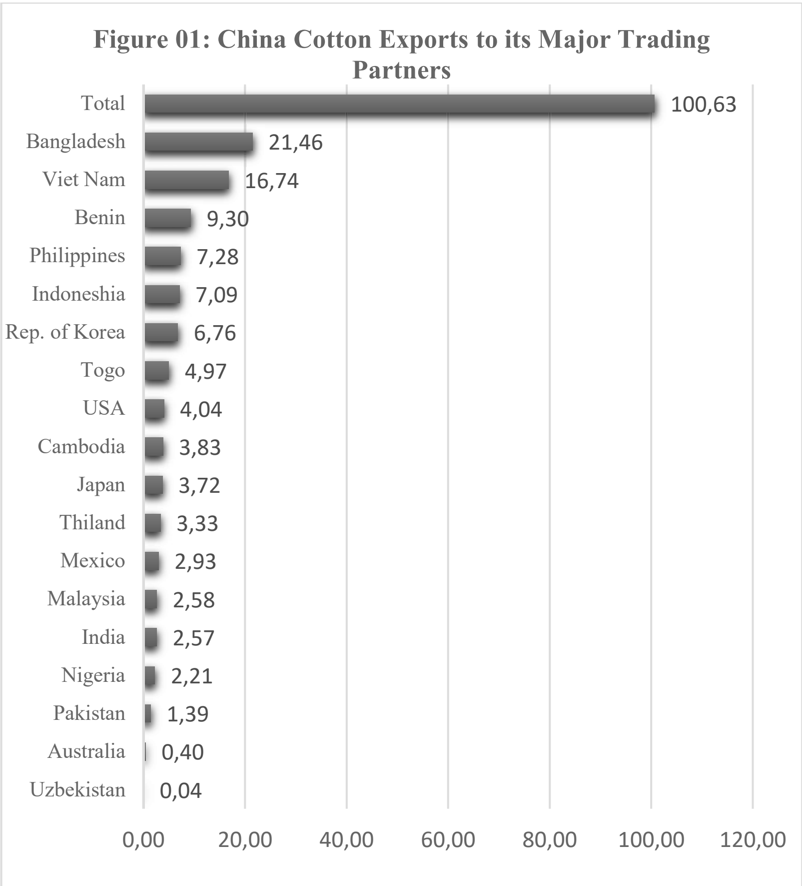
The above equation is estimated with a Poisson regression and average marginal effects of the gravity model. Frome et al. (1973) described a method of regression analysis for Poisson distribution data with both linear and nonlinear regression models in the explanatory variables. Poisson regression methods provide an appropriate means for analysing count data, which occurs frequently in a wide variety of applications. Such data typically exhibit a strong mean-variance relationship, and this is often a near-equality relationship, as in the Poisson distribution, which is then the appropriate distribution to use because it also reflects the discreteness in the data. If the counts are large, then the discreteness ceases to be important, and the Poisson distribution will be well approximated by a normal distribution with a variance equal to the mean (Hinde J, 1982).

Advantages of a Poisson Regression Model

The Poisson model overcomes some of the problems of the normal model. First, the Poisson model has a minimum value of 0. It will not predict negative values. This makes it ideal for a distribution in which the mean or the most typical value is close to 0.

4. Empirical Results

In this section, the descriptive statistics, changes in the structure, and the value of the cotton trade are calculated. Figure 01 shows China's exported cotton during the period of 2000-2017. In this time, China's total cotton exports to 18 partners amounted to $85.94 billion. Vietnam is the second-largest importer of cotton, whereas Benin is the third-largest importer of cotton from China. Similarly, Table 2 presents the nominal value of cotton imports from China of selected countries over the selected time interval. The 18 importing countries present the aggregate value of cotton products. The value of Bangladesh cotton imports from China was US$ 0.20 billion in 2000 and 2001, which increased to US$ 2.37 billion in 2017. Out of the 18 countries that import cotton from China, Bangladesh is the largest importer of cotton from China. The second-largest importer of cotton from China is Vietnam, which imported $1.66 billion worth of cotton in 2017.



Source: Authors' own calculation from UN Com trade data.

Table 2. The nominal value of cotton imports from China to its major importing countries (billion US%).

Year	Australia	Bangladesh	Benin	Cambodia	India	Indonesia	Japan	Malaysia	Mexico	Nigeria	Pakistan	Philippines	R. of Korea	Thailand	Togo	USA	Uzbekistan	Vietnam	Total
2000	0.03	0.20	0.05	0.03	0.03	0.12	0.16	0.05	0.02	0.01	0.00	0.04	0.29	0.08	0.01	0.14	0.00	0.02	1.31
2001	0.02	0.20	0.08	0.05	0.02	0.07	0.14	0.02	0.03	0.02	0.00	0.04	0.25	0.04	0.02	0.12	0.00	0.02	1.15
2002	0.03	0.25	0.14	0.06	0.03	0.12	0.18	0.03	0.08	0.03	0.01	0.06	0.31	0.06	0.04	0.12	0.00	0.07	1.64
2003	0.03	0.36	0.22	0.08	0.05	0.16	0.24	0.03	0.12	0.08	0.01	0.07	0.33	0.12	0.07	0.13	0.00	0.12	2.22
2004	0.03	0.40	0.20	0.12	0.08	0.16	0.27	0.04	0.16	0.04	0.01	0.09	0.30	0.09	0.09	0.12	0.00	0.15	2.33
2005	0.02	0.54	0.31	0.13	0.12	0.24	0.26	0.06	0.10	0.03	0.01	0.10	0.37	0.11	0.11	0.21	0.00	0.21	2.91
2006	0.02	0.69	0.42	0.11	0.14	0.33	0.28	0.05	0.12	0.02	0.01	0.11	0.42	0.15	0.13	0.21	0.00	0.27	3.48
2007	0.02	0.75	0.64	0.13	0.16	0.39	0.25	0.06	0.09	0.01	0.02	0.10	0.40	0.18	0.17	0.21	0.00	0.37	3.96
2008	0.02	0.98	0.99	0.14	0.14	0.41	0.24	0.10	0.10	0.02	0.02	0.10	0.41	0.22	0.23	0.25	0.00	0.45	4.81

2009	0.01	0.89	0.80	0.11	0.12	0.36	0.19	0.18	0.13	0.03	0.01	0.14	0.40	0.21	0.24	0.20	0.00	0.63	4.68
2010	0.02	1.33	0.85	0.19	0.20	0.55	0.25	0.14	0.17	0.07	0.05	0.17	0.57	0.29	0.39	0.29	0.02	1.17	6.74
2011	0.03	1.79	0.85	0.28	0.18	0.66	0.31	0.18	0.25	0.12	0.07	0.28	0.56	0.27	0.58	0.29	0.00	1.56	8.27
2012	0.02	1.83	0.59	0.30	0.21	0.61	0.22	0.26	0.26	0.19	0.08	0.49	0.40	0.27	0.72	0.29	0.00	1.46	8.19
2013	0.02	2.16	0.92	0.38	0.28	0.65	0.19	0.30	0.23	0.19	0.08	0.80	0.43	0.26	0.51	0.29	0.00	2.50	10.18
2014	0.03	2.15	0.85	0.39	0.22	0.65	0.17	0.33	0.27	0.18	0.18	0.46	0.37	0.25	0.59	0.28	0.00	2.38	9.74
2015	0.02	2.26	0.59	0.40	0.19	0.56	0.13	0.38	0.26	0.58	0.37	0.84	0.35	0.27	0.38	0.35	0.00	2.00	9.94
2016	0.02	2.32	0.35	0.40	0.19	0.51	0.12	0.19	0.25	0.23	0.25	1.53	0.34	0.23	0.34	0.26	0.00	1.69	9.25
2017	0.02	2.37	0.44	0.53	0.21	0.53	0.11	0.19	0.26	0.35	0.20	1.85	0.26	0.24	0.34	0.28	0.01	1.66	9.84
Total	0.40	21.46	9.30	3.83	2.57	7.09	3.72	2.58	2.93	2.21	1.39	7.28	6.76	3.33	4.97	4.04	0.04	16.74	100.63

Table 3. Nominal value of Chinese cotton exports to selected countries over the selected period intervals (billion US$)

Country	2000-2005	2006-2011	2012-2017	Total
Australia	0.16	0.11	0.13	0.40
Bangladesh	1.95	6.42	13.09	21.46
Benin	1.00	4.56	3.74	9.30
Cambodia	0.47	0.97	2.39	3.83
India	0.32	0.94	1.30	2.57
Indonesia	0.88	2.71	3.51	7.09
Japan	1.25	1.51	0.96	3.72
Malaysia	0.23	0.71	1.65	2.58
Mexico	0.52	0.88	1.53	2.93
Nigeria	0.21	0.27	1.73	2.21
Pakistan	0.04	0.18	1.16	1.39
Philippines	0.40	0.91	5.96	7.28
Rep. of Korea	1.84	2.77	2.15	6.76
Thailand	0.50	1.32	1.52	3.33
Togo	0.34	1.75	2.88	4.97
USA	0.84	1.46	1.74	4.04
Uzbekistan	0.00	0.02	0.04	0.06
Vietnam	0.60	4.45	11.69	16.74
Total	11.55	31.94	57.17	100.66
	Percent Share			
Australia	0.16	0.11	0.13	0.40
Bangladesh	16.86	20.10	22.91	21.32
Benin	8.67	14.27	6.54	9.24
Cambodia	4.06	3.04	4.19	3.81
India	2.80	2.96	2.27	2.55
Indonesia	7.59	8.48	6.14	7.05
Japan	10.82	4.73	1.68	3.70
Malaysia	1.97	2.22	2.88	2.57
Mexico	4.51	2.75	2.68	2.91
Nigeria	1.85	0.84	3.02	2.20
Pakistan	0.38	0.58	2.03	1.38
Philippines	3.50	2.85	10.44	7.23
Rep. of Korea	15.92	8.67	3.76	6.71
Thailand	4.29	4.12	2.65	3.31
Togo	2.92	5.47	5.05	4.94
USA	7.27	4.57	3.05	4.01
Uzbekistan	0.03	0.07	0.07	0.04
Vietnam	5.17	13.93	20.46	16.63

Table 3 presents the value of the exports of the selected countries in three-year intervals and the changes in the share of these countries in the total cotton products trade of the selected countries. Table 3 shows the nominal value of the cotton imports of selected countries over the selected time intervals from 2000 to 2017. The nominal value of Bangladesh cotton imports increased, and Bangladesh remains the largest consumer and importer of cotton from China. China accounted for 0.16 percent of the cotton from 2000-2005. This proportion increased to 21.46 percent in the 2012-2017 time period. Vietnam is the second-largest cotton importer from China. Vietnam accounted for 0.60% of cotton imports from 2000-2005. This proportion increased to 16.74% in the 2012-2017 time period.

4.1 Empirical Results

The results of the Poisson regression along with average marginal effects of the gravity model equations are presented in Table 5. The results of the Poisson regression in Table 5 show that an increase in importer GDP significantly increases China's cotton exports. The importer GDP coefficient is positive with an estimated value of 0.054, i.e., holding constant for all other variables, a one-percent increase will result in an approximately 0.054% increase in Chinese cotton exports. The highly significant coefficient of China's GDP is positive with an estimated value of 0.21396. This result shows that keeping all else constant, a one-percent increase in China’s GDP will increase cotton exports from China by 0.21396 percent, and a higher GDP of the reporter country shows higher production potential that may lead to higher exports. According to Garcia, Pabsdorg, and Herrera (2013), exporter GDP has a positive influence on trade. The high outcome is reliable with the basic assumption of the gravity model that shows that trade will increase with an increase in the market size. In contrast, GDP per capita is negatively associated with China's cotton exports. This signifies that a one-percent increase in importing countries' GDP per capita will decrease China's cotton exports by -1.52%. Our findings are supported by Abidin, Bakar, and Sahlan (2013), ZainalAbidin et al. (2015), Bhavan (2016), and Metulini, Patuelli, and Griffith (2018); similarly, in their empirical studies, they found that per capita GDP has negative effects on trade. Likewise, Unakitan and Aydin (2012) found that per capita GDP is negatively correlated with the total exports of Egypt. The population has a positive effect on trade flows between China and its trading partners as an increase in population increases exports and imports. According to He, Kwamena, and Wang (2013), the importer population has a large and positive effect on exports because more research and development and labour involve the production process.

Furthermore, exchange rate variations also have significant effects on agricultural trade, as suggested by Cho, Sheldon, and McCorriston (2002) and Huchet-Bourdon and Bahmani-Oskooee (2013). A higher exchange rate normally has a positive effect on agricultural exports (Kandilov, 2008). In this study, the exchange rate has a significant positive effect on China's cotton exports. The positive coefficient shows that a devaluation in China's currency against the currencies of its partner's countries increases cotton exports. The exchange rate has a great influence on the exports of some developing nations, as indicated by Chaudhary, Hashmi and Khan (2016), which implies that a fall in comparative domestic prices due to exchange rate devaluation makes exports inexpensive in global markets and results in increased demand for exports (Shi & Li, 2017; Temitope & Akani, 2017; Mahmood et al., 2017; Tran, Phi, & Diaw, 2017; Tumwebaze & Karamuriro, 2015). According to Eve, Chan and Au (2007), the real exchange rate plays a crucial role in determining the volume of textile exports from China. When there is a 10% real depreciation/appreciation in RMB against foreign currency, there will be a 2% increase/decrease in exports.

Moreover, tariffs have negative effects on China's cotton exports. This implies that when the tariff rate is higher, the imports of a country are lower. Our results indicate that a 1-percent increase in the tariff rate will decrease cotton exports of China by -0.1163 percent. The distance has a negative relation with China's cotton exports, and the transport cost is relevant to the distance. This signifies that cotton trade decreases with an increase in the distance between China and its trading partners. This finding is consistent with the basic gravity equation that suggests that a greater distance tends to decrease trade due to high transportation (Aitken, 1973; Bergstrand, 1985, Bikker, 1987; Brada and Mendez, 1983; Frankel and Rose, 2002; Linneman, 1966; Thursby and Thursby, 1987). Our results are also consistent with those of previous studies (Fadeyi et al., 2014; Sun & Reed 2010).

Table 5. Gravity model estimation results of Chinese cotton exports

	The gravity model of the cotton-estimated Poisson regression	Average marginal effects of the cotton estimated using the Poisson method
Variables	**Cotton**	**Cotton**
China GDP	3.76*** (0.000)	0.21396*** (0.000)
Importers GDP	3.79*** (0.000)	0.05400*** (0.000)
Exchange Rate	0.00076*** (0.000)	0.11617*** (0.000)
China Pop	1.23*** (0.000)	1.6281*** (0.000)
Importers Pop	3.97*** (0.000)	0.00539*** (0.000)
China GDPPC	0.00053*** (0.000)	0.21831*** (0.000)
Importers GDPPC	-1.52*** (0.000)	-0.04205*** (0.000)
Distance	-0.00015*** (0.000)	-0.09591*** (0.000)
Tariffs	-0.1163*** (0.000)	-0.82791*** (0.000)
Common Border	-0.0414*** (0.000)	-0.0069*** (0.000)
Constant	17.618*** (0.000)	
Fixed Effects		
Year	2.4e+09***	
Partner	5.9e+10***	
Number of Observation	432	
Pseudo R-Squared	0.7028***	

*Source: Author estimation. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1*

5. Conclusion and Policy Recommendations

This study explored China's cotton exports and their determinants for the Chinese economy by using the gravity model. The analysis examined China's cotton exports to its 18 major trading partners during the period of 2000 to 2017. Evidence from the empirical results of the Poisson regression indicated that among the control variables, the partner population has a positive influence on China's cotton exports, as the increase in the population of the importer countries increases the demand for imports. The empirical findings also suggested that the depreciation of the Chinese Yuan against the currencies of its importing countries encourages cotton exports, the government should keep stabilizing the exchange rate, and the government should implement appropriate exchange rate policies for regulating the real exchange rate, since this is more suitable to the acceleration of output capability and economic growth. The results also suggested that Chinese cotton exports appear to decrease with a rise in the tariff rate of partner countries, as tariffs have a significant negative impact on Chinese cotton exports. The traditional variables in the gravity equation, such as GDP, have a positive impact, while distance has a negative impact on cotton exports, which suggests that greater distance tends to decrease trade due to high transportation costs. However, geographical distance is no longer a major hindrance to international trade, as technological improvements in international transportation and a reduction in transportation costs can reduce the adverse impact of distance on international trade.

This study recommends that China should make efforts to reduce the cost of trade in cotton with neighbouring countries such as Pakistan, India, Bangladesh, and Afghanistan to achieve deeper economic integration. For this reason, logistics are very important for exports, which could be strengthened by improved interconnections such as structure, air travel, and improved maritime transport between China and its importing partners. In future research work, disaggregated export data will be analysed, and other major determinants or trade potential will be estimated.

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