

Using gravity model to forecast the potential range distance of market share between China and the five central Asian countries for their cross-border e-commerce and relative countermeasures

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Abstract: It is proposed that the development opportunity of ‘One Belt, One Road’ should be grasped and emerging markets should be actively explored; international co-operation in e-commerce should be actively promoted at the national level, so as to create a favorable international regulatory environment for the development of cross-border e-commerce; an all-round, high-efficiency and integrated service system led by the governments of various levels should be constructed to enhance the facilitation of cross-border e-commerce; the construction of cross-border e-commerce logistics infrastructures should be accelerated, and cross-border e-commerce logistics infrastructure should be improved. The government should also speed up the construction of cross-border e-commerce logistics infrastructure, improve the overseas warehousing system and enhance the efficiency of cross-border services; innovate cross-border e-commerce financial services and accelerate the development of blockchain technology; and strengthen the construction of export brands to enhance competitiveness.

Keywords: Central Asian countries, Cross-border e-commerce, Gravity modelling, Market potential.

1. Introduction

Since the 21st century, cross-border e-commerce, as a new form of e-commerce, has been receiving more and more attention from governments and enterprises as well as favor from consumers worldwide. The WCO Framework of Standards for Cross-Border E-Commerce states that ‘the rapidly growing form of physical trade in goods in the field of cross-border e-commerce creates enormous opportunities for global economic development, providing new growth drivers, giving rise to new trade patterns, and leading to new consumption trends’ [1]. At present, with the wave of digital economic globalization and the rapid development of cross-border e-commerce, research in the field of cross-border e-commerce has gradually become the focus of scholars' attention. Research on cross-border e-commerce between China and Central Asian countries is still in its infancy. The Outcome Document of the 2019 Summit of the Council of Heads of State of the Shanghai Cooperation Organization (SCO), ‘Exploiting Central Asian Markets in Cross-Border E-Commerce Seeking New Opportunities,’ and other points out that ‘China should strengthen trade cooperation with Central Asian countries, create a Central Asian cross-border e-commerce platform, and strengthen the construction of the supply chain, logistics, distribution and warehousing support facilities, so as to promote the popularity and development of cross-border e-commerce.’ Currently, ‘Central Asia Cloud Products’ featured e-commerce activities in Xi'an to online and offline way to display and sell Central Asian countries featured commodities, cross-border e-commerce can be imported goods and international supply chain, to provide consumers with a more diversified choice of products, to improve brand awareness and international influence [2]. Song Haixia [3], Hou Jie et al [4], Mao Jiaqing [5], Zhang Hanmei [6] respectively for China and ASEAN, RCEP countries, Russia, Kazakhstan cross-border e-commerce trade research, but about China and five Central

Asian countries cross-border e-commerce trade systematic, comprehensive academic research is less, most of them are news and reports, the lack of data support and theoretical basis, and the policy recommendations lagging behind the development of China and the five Central Asian countries cross-border e-commerce. The lack of data support and theoretical basis, as well as policy recommendations lagging behind the real needs of cross-border e-commerce development between China and Central Asian countries, highlight the importance of this study. With regard to the measurement of cross-border e-commerce trade potential, scholars have mostly adopted the gravity model for empirical analyses. Yu Yang used the extended gravity model to measure China's export potential for cross-border e-commerce, and came up with the following conclusions: 10 countries, including South Korea, India, and Japan, are 'high potential'; 50 countries, including France, Germany, and Italy, are 'high potential'; Costa Rica, Mauritius, Malta, Chile, and the United States are 'high potential'; and the potential for cross-border e-commerce in Central Asia is 'high potential'. Costa Rica, Mauritius, Malta, Chile and Uruguay are 'potential re-modelling' [3]. Meng Xiangming et al. introduced the stochastic frontier gravity model for empirical analysis and concluded that China's cross-border e-commerce export trade of agricultural products to the Middle East, Africa, and European countries is less efficient and has a higher potential value, while its cross-border e-commerce export trade of agricultural products to Japan and the United States is more efficient [7]. Mao Jiaqing measured the trade efficiency and trade potential of China-Russia cross-border e-commerce using the stochastic frontier gravity model and concluded that the trade potential of China-Russia cross-border e-commerce rose from 29.88 in 2010 to 137.32 in 2019 [5]. Mao Jiaqing believes that the influencing factors between China and Russia cross-border e-commerce include economic factors, the level of e-commerce development, infrastructure services and quality, the level of logistics performance, the strength of government regulation, as well as the size of the population, the number of Internet users and geographic distance between China and Russia [5]. There are many factors affecting the development of cross-border e-commerce, and the academic community has not yet formed a consistent standard. Research and practice on cross-border e-commerce models are still in the exploratory stage. The globalisation and expansion of China's cross-border e-commerce trade has also continuously given rise to new cross-border e-commerce models. To sum up, the existing studies have laid a certain foundation, but there are still shortcomings and deficiencies: there are fewer academic studies on the potential of cross-border e-commerce trade between China and Central Asian countries, and there is a lack of quantitative analyses, data support, and effective policy recommendations; due to the differences in the level of economic development, computer and communication technology, and openness to the outside world of the countries in Central Asia, the potential of bilateral cross-border e-commerce trade varies, and the existing studies have not analyzed the inherent differences and linkages, and have not analyzed their potential. Existing studies have not analyzed the differences and linkages and have not explored appropriate development models for the potential of cross-border e-commerce in different countries. Therefore, this study aims to conduct in-depth research on the scientific issues related to the potential of cross-border e-commerce market between China and Central Asian countries, to further explore the potential of bilateral cross-border e-commerce trade, and to put forward corresponding policy recommendations, so as to deepen bilateral cooperation in the field of cross-border e-commerce, and to work together to build a common destiny in cyberspace or even a closer community of destiny between China and Central Asia.

2. Analytical Modelling

In the traditional state of gravity model, the potential of international trade is limited by the size of the market and distance between the two trading parties, so the formula is as follows. $\ln trade_{ij} = \beta_0 + \beta_1 \ln gdp_{ij} + \beta_2 \ln dist_{ij} + \mu_{ij}$ (1) where $trade_{ij}$ denotes the trade volume of both countries i and j , gdp_{ij} denotes the level of economic development (gdp) of country i and j at time t , and $dist_{ij}$ is the spatial distance between country i and j . Regarding the research on cross-border e-commerce trade influencing factors and potential empirical analysis model, Yu Yang used the extended gravity model to empirically analyse China's cross-border e-commerce export influencing factors and potential, and chose the level of development of cross-border e-commerce, per capita gross domestic product (GDP) of importing

countries, population size, economic distance of both sides of the trade, the importing country's weighted tariff level and degree of openness to the outside world, etc., to construct the empirical analysis model [8] ; Zheng Chunfang et al. Zheng Chunfang and others chose GDP per capita, total population of the importing country, trade facilitation, economic distance between the two trading parties, tariff level of the importing country, and the openness of the importing country to build a model of China's cross-border e-commerce trade potential and measure the potential of China's cross-border e-commerce exports [9]; Song Haixia chose the GDP per capita, the total population, the trading distance between the two trading parties, the level of e-commerce development, and the quality of road construction. Haixia Song chose GDP per capita, total population, transaction distance between trading parties, e-commerce development level, and road infrastructure construction quality to construct a cross-border e-commerce potential model between China and ASEAN countries [3]. Chen Tingting included the Internet penetration rate, economic development level, population size and other indicators into the influencing factors, and constructed an extended gravity model to investigate China's potential for cross-border e-commerce development in ASEAN countries, and came to the conclusion that China's cross-border e-commerce development potential in Singapore, Malaysia, Thailand, Indonesia, and Myanmar is strong, and that the cross-border e-commerce development potential in Brunei, Cambodia, Vietnam, the Philippines, and Laos still needs to be further explored [10]. It is concluded that China has strong potential for cross-border e-commerce in Singapore, Malaysia, Thailand, Indonesia and Myanmar, while the potential for cross-border e-commerce between Brunei, Cambodia, Vietnam, the Philippines and Laos still needs to be further explored [10].

Therefore, based on the existing literature, the article further extends the gravity model, comprehensively considering the level of economic development (P_{gdp}), population size (pop), cross-border e-commerce development level ($cbec$), Internet application (net), consumer price index (cpi), the level of openness to the outside world ($open$), and the transport distance ($dist$) indicators on the impact of China's cross-border e-commerce trade with Central Asian countries as shown in equation (2). The impact of cross-border e-commerce trade between China and Central Asian countries, to construct the extended gravity model as shown in equation (2). $\ln trade_{ij} = \beta_0 + \beta_1 \ln P_{gdp_{ij}} + \beta_2 \ln pop_{ij} + \beta_3 cbec_{ij} + \beta_4 \ln net_{ij} + \beta_5 \ln cpi_{ij} + \beta_6 \ln open_{ij} + \beta_7 \ln dist_{ij} + \mu_{ij}$ (2) where the explanatory variable, $etrade_{ij}$, denotes the volume of cross-border e-commerce import and export trade between China and Central Asian countries. The explanatory variables are the economic development level (P_{gdp}), population size (pop), cross-border e-commerce development level ($cbec$), Internet application (net), consumer price index (cpi), external openness level ($open$), and transport distance ($dist$) of China and Central Asian countries, respectively, and the time period of the study is 2013-2020 (Table 1).

Table 1.
Description of the variables in the gravity model.

Dependent variable	Argument	Meaning	Source
China's cross-border e-commerce import and export trade with central Asian countries etrade _{ij}	Pgdp _{ij}	Per capita GDP (Purchasing power parity, ten thousand dollars)	Fast financial network easy database https://www.kylc.com/stats
	Pop _{ij}	Population size (Ten thousand people)	Global macroeconomic data
	Cbec _{ij}	Development level of cross-border e-commerce	Measure ured using principal component analysis
	Net _{ij}	Internet applications	World bank data
	Cpi _{ij}	consumer price index	World bank data
	Open _{ij}	Open to the outside world	UN comtrade database and the calculation
	Dist _{ij}	transportation range	The distance between the two capitals comes from the CEPII database, the price of crude oil Was derived from the World Bank Data

The level of economic development (Pgdp) variable, expressed in terms of gross domestic product (GDP) per capita (purchasing power parity), reflects the level of economic development on both sides of the trade. Population size (pop) variable, which can reflect the potential capacity of the market. Usually, the larger the population, the more demand for goods if the income level remains constant, and the greater the demand for cross-border e-commerce market. The level of cross-border e-commerce development (cbec) variable, generally more economically developed countries cross-border e-commerce development is also at a higher level. Internet application (net) variable, the current mobile Internet, Internet of Things, cloud computing, big data and other new technologies, new businesses, new forms of endless, the breakthroughs and applications of artificial intelligence technology for the development of cross-border e-commerce industry has brought new opportunities. The wider the general Internet application, the more favorable it is to the development of cross-border e-commerce. Consumer price index (cpi) variable, reflecting the price of goods and services related to the life of residents' statistical price change indicators, usually as an important indicator to judge the degree of inflation, can reflect the price level: China and Central Asian countries cross-border e-commerce trade potential and innovation model research and consumer purchasing power. Openness (open) variable, refers to the degree of opening up of a country or region's economy to the outside world, expressed as the ratio of the total amount of imports and exports to the GDP, as an assessment and measurement of openness, this indicator is specifically expressed as the degree of market openness, which is an important indicator to measure the level of opening up of a country's economy to the outside world. The transport distance (dist) variable is the transport distance between the capitals of the two trading countries, and this salt is calculated by multiplying the distance between the capitals of the two countries by the average price of petrodollar in the current year, based on the practice of Zheng Chunfang et al [9]. In addition, μ_{ij} is a constant term, which is generally expressed as 1 for having a common border between the trading countries and 0 for not having one, but since China borders most of the countries in Central Asia and has a common border, the indicator is not very different. Therefore, the constant term is not counted.

2.1. Data Sources

This study involves a total of 2015–2022 data of China and five Central Asian countries, and the article interpolates the missing data of individual countries. The variables involved in the extended gravity model are shown in Table 1, and the data are mainly obtained from internationally recognized authoritative databases.

3. Analysis and Discussion of Results

Using the extended gravity model for regression analysis, specific to each variable, China's actual cross-border e-commerce trade volume with Central Asian countries and the level of economic development, the level of cross-border e-commerce development, the Internet application, the level of opening up to the outside world, the transport distance indicators are significantly positively correlated with the consumer price index has a more significant negative correlation with the performance of the size of the population is not significant. This indicates that with the economic growth of Central Asian countries, the level of cross-border e-commerce development, the wide application of the Internet and the deepening of the degree of opening up to the outside world, the potential of China's cross-border e-commerce trade with Central Asian countries will be stimulated; the high level of the Consumer Price Index, i.e., inflation, will inhibit the growth of cross-border e-commerce trade in the trading countries; the more distant the distance is, the more likely it is that the trade potential will be restricted, but because the transport distance indicator is linked to the price of oil, abnormal fluctuations in the price of oil on the international market have a significant impact on the indicator. The level of cross-border e-commerce development has a significant impact on bilateral cross-border e-commerce trade; for every 1% increase in the level of cross-border e-commerce development, the volume of cross-border e-commerce trade between China and China-Asia countries will increase by 1.48%. The process of digital economy globalization has accelerated, and under the 'Belt and Road' initiative, China has continuously deepened its cooperation with Central Asian countries in the areas of digital infrastructure and cross-border e-commerce, and Central Asian countries have continuously improved their Internet and communication technologies, logistics efficiency, customs clearance efficiency and education and scientific research levels. Specifically, indicators such as fixed broadband Internet users, Internet penetration rate, number of Internet security servers, railway transport volume, ability to track and enquire about goods, logistics performance composite score, burden of customs procedures, customs clearance facilitation, efficiency of customs clearance procedures, R&D and higher education have contributed to the increased level of cross-border e-commerce development in Central Asian countries, and stimulated the potential of China's cross-border e-commerce trade with Central Asian countries (Table 2).

Table 2.
Results of gravity model regression analysis.

Variable	Coefficient	Standard error	T	P> T	And the 95% confidence interval	
ln pgdp _{ij}	0.703	0.137	5.202	0.000	0.439	0.967
ln pop _{ij}	-0.268	0.193	-1.403	0.165	-0.640	0.109
Cbec _{ij}	1.487	0.701	2.133	0.037	0.119	2.856
ln net _{ij}	0.423	0.146	2.933	0.004	0.143	0.706
ln cpi _{ij}	-0.992	0.572	-1.753	0.084	-2.113	0.120
ln open _{ij}	0.371	0.204	1.832	0.069	-0.028	0.764
ln dist _{ij}	0.477	0.189	2.543	0.015	0.112	0.845
_cons	4.531	4.582	0.993	0.325	-4.451	13.511

Source: Calculated using STATA 17.0.

In summary, based on the expansion of the gravity model to obtain China and Central Asian countries cross-border e-commerce trade potential coefficient, that is, the ratio of the actual trade volume and trade forecast to measure the size of the bilateral trade potential, using K to reflect the trade

potential. Drawing on Zheng Chunfang et al [9], Deng Yujia et al [11] to define the trade potential level of the standard, if $K \leq 0.8$, it is a huge potential market, that is, in the existing conditions and e-commerce mode of cross-border e-commerce trade of the country there is still a large space for expansion; if the K value of $0.8 \sim 1.2$, it is the potential to expand the type of market, that is, the potential of cross-border e-commerce trade of China and Central Asian countries has not yet reached the peak, there is still some If K is $0.8 \sim 1.2$, it is a potential expanding market, that is, China's cross-border e-commerce trade potential with the country has not yet reached its peak and still has certain development potential; if K is ≥ 1.2 , it is a potential re-modelling market, that is, China's cross-border e-commerce trade with the country has limited room for growth, and it needs to innovate the trade mode or expand into new trade areas in order to realise the trade growth (Table 7). Thus, from the perspective of cross-border e-commerce trade potential data: (1) cross-border e-commerce between China and Kazakhstan in 2020 belongs to the 'potential re-modelling', which means that in addition to the existing variables, it is also necessary to cultivate new variables, stimulate their impact on the potential of cross-border e-commerce trade between the two sides, create new advantages, and recreate the prosperity of cross-border e-commerce trade. The cross-border e-commerce trade between China and Uzbekistan belongs to the 'potential expansion type', and the development potential of cross-border e-commerce trade between the two sides still needs to be further strengthened. China's cross-border e-commerce trade with Tajikistan and Turkmenistan is of the 'great potential' type, and the development potential of cross-border e-commerce trade between the two sides still has a lot of room for improvement; China's cross-border e-commerce trade potential with Tajikistan and Turkmenistan is unknown due to the lack of data, and the openness of the cross-border e-commerce data elements in the trade and the cooperation are still insufficient, which is in urgent need of crossing the digital divide; (2) the status of the five countries in Central Asia's trade potential during the study period varied significantly. Among the five Central Asian countries, Kazakhstan and Kyrgyzstan have experienced three types of status changes, Uzbekistan and Turkmenistan have experienced 'expanding potential' and 'huge potential' changes, and Tajikistan has always been in the 'huge potential' type. Overall, four of the five Central Asian countries have been in the 'great potential'; (3) Combined with the regression results of the trade gravity model, the reasons for the differences in cross-border e-commerce trade potential are mainly focused on the differences and linkages between the two sides in terms of their levels of economic development, cross-border e-commerce development, Internet application, and opening up to the outside world (Table 3). (Table 3).

Table 3.

China's potential distance analysis of cross-border e-commerce market share to the five central Asian countries (2015-2022).

Country	In 2015, Potential potential distance value status	In 2016, Potential, potential distance value status	In 2017, Potential, potential distance value status	In 2018, Potential, potential distance value status	In 2019, Potential, potential distance value status	In 2020, Potential, potential distance value status	In 2021, Potential potential distance value status	In 2022, Potential potential distance value status
Kazakhstan	1.255 potential styling	1.053 potential expansion type	0.771 type with great potential	0.743 type 1 with great potential	0.950 potential expansion type	1.037 potential expansion type	1.117 potential expansion type	1.265 potential styling
Kyrgyzstan	0.772 type with great potential	1.127 potential expansion type	1.497 potential styling	2.294 potential styling	1.125 potential expansion type	0.981 potential expansion type	0.765 type has great potential	0.431 potential potential
Uzbekistan	0.951 potential expansion type	0.840 potential expansion type	0.875 potential expansion type	0.792 type 1 with great potential	0.853 potential expansion type	0.890 potential expansion type	0.952 potential expansion type	0.892 potential expansion type
Tadzhikistan	0.460 has great potential	0.747 type with great potential	-4.691 has a huge potential type	-0.880 has a huge potential type	-0.993 potential potential	-	-	-
Turkmenistan	0.843 potential expansion type	0.980 potential expansion type	1.121 potential expansion type	0.782 type 1 with great potential	0.796 potential expansion type	-	-	-

Note: Compiled from econometric analyses of gravity models.

4. The Diversity and Differences in the Needs of Countries Along the Belt and Road Have Opened Up Market Space for the Development of Export Cross-Border E-Commerce

According to eMarketer's forecast, global e-commerce sales will reach US\$4.9 trillion by 2021, accounting for 17.5% of total global retail sales. Mature markets such as Europe, the U.S., Japan and South Korea are huge in scale and are the mainstay of China's cross-border export market, but have yet to form a monopoly. With the rise of Internet penetration rate and the gradual opening of cross-border e-commerce policies in emerging markets, the development potential is huge. In terms of cross-border B2C transaction scale, the Asia-Pacific region is the largest, accounting for 30% of the world, and Latin America, the Middle East, Africa and Central Asia are the fastest growing regions. In Russia, 90 per cent of the goods purchased online by cross-border e-commerce come from China, which is regarded as the market with the greatest potential for cross-border e-commerce. Australian consumers' willingness to buy goods from China is not strong at the initial stage, but the actual transaction rate eventually reached 56 per cent, far exceeding that of goods from other countries, and Amazon Australia is regarded as a new opportunity for Chinese sellers. Israeli e-commerce, 75 per cent of Israeli online consumers will buy Chinese goods, followed by goods from the United States, the United Kingdom and Brazil. Southeast Asia is a major region for trade co-operation between China and the countries along the Belt and Road, with rapid growth in Internet penetration and e-commerce penetration, and e-commerce development is in an explosive phase. In the Middle East, the markets of different countries vary greatly, and the digital penetration of consumers is increasing, so e-commerce sales are at a relatively low level, but e-commerce trade in fashion, cosmetics, and electronic goods has great potential, and some Chinese brands have high recognition and affinity among consumers. Due to the demographic characteristics and environmental factors of different regions, there is a high demand for differentiated products, which provides cross-border e-commerce companies with a good third-party sales venue. As the 'world's factory', China has a wide range of products, competitive prices and production capacity, and its main export commodities are highly compatible with the world's most popular cross-border e-commerce products. Chinese companies have a great advantage in participating in export cross-border e-commerce.

Innovate financing, insurance, and other financial products, and establish credit insurance capital pools to improve the trading capacity of small and medium-sized cross-border e-commerce enterprises. Innovate insurance services and make use of cross-border e-commerce Internet big data to provide financing for cross-border e-commerce exports. Provide financial support for cross-border e-commerce export business from overseas warehouses through co-operation with export credit insurance and comprehensive foreign trade service platforms. In terms of cross-border payment, the data channel between cross-border e-commerce platforms and bank settlement systems should be opened up, so as to integrate logistics data, capital information and commodity data to form a brand-new e-commerce-based international trade system to cater for the requirements of flexible and changeable online transactions. Compared with the current cross-border payment mode, blockchain technology eliminates the need for transit banks and realizes point-to-point cross-border payment at a fast and low cost. On the one hand, blockchain technology bypasses transit banks and enables 24-hour cross-border payments with immediate delivery, speeding up cross-border transactions and eliminating many handling and platform fees. According to McKinsey, cross-border payments under blockchain technology will reduce the cost of each transaction by 42 per cent. Globally, the application of blockchain technology in B2B cross-border payment and settlement business can reduce the cost of each transaction from \$26 to \$15, with 75% of the reduced cost being the maintenance fee of the payment network of the transferring bank, and 25% being the cost of compliance, error investigation and foreign exchange. Secondly, blockchain technology has the characteristics of decentralization, non-tampering of information and anonymity, which greatly improves the security and transparency of cross-border payments and reduces the risks of cross-border payments. Blockchain technology can provide different levels of solutions for cross-border payments, from using digital currencies to act as foreign exchange intermediaries to providing technical support and underlying protocols to banks, building decentralized global payment systems, and gradually phasing out the traditional costly SWIFT channel.

5. Conclusion

This study of cross-border e-commerce market potential between China and five Central Asian countries concludes that there are significant differences in the trade potential status of the five Central Asian countries, and that the cross-border e-commerce trade potential status between China and the Central Asian countries dynamically evolves over time. Overall, although China's cross-border e-commerce trade potential with Central Asian countries fluctuates more frequently from year to year, and the status changes, four out of the five Central Asian countries were once in the 'high potential' category. Along with the globalization of the digital economy and the implementation of the Belt and Road Initiative, the cross-border e-commerce industry will become an engine for the optimization of the trade structure and its high-quality development between China and Central Asia.

Export cross-border e-commerce is faced with increased government regulation of the cross-border e-commerce market and tightened tax policies, which increase the risk of export cross-border e-commerce; low efficiency and high cost of cross-border logistics, which reduces customer satisfaction; cross-border payment is subject to fraud, transaction and capital risks; and weak awareness of intellectual property rights and a lack of brand positioning among enterprises lead to homogeneous and low-priced competition. At the national level, the Chinese government should continuously and deeply participate in the international governance of cross-border e-commerce, and actively promote the international cooperation mechanism of e-commerce to create favorable international rules for the development of cross-border e-commerce; in terms of institutional innovation, governments at all levels should take the lead in constructing a comprehensive cross-border e-commerce service system through the formulation of technical standards, the standardization of business processes, and the establishment of a supervisory model to enhance the facilitation of cross-border e-commerce trade; and exporters should Export enterprises should seize the development opportunity of 'Belt and Road', explore emerging markets, accelerate the layout of cross-border e-commerce logistics, pay attention to brand building and improve product competitiveness.

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