

# Russia-China Natural Gas Trade Research

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**Abstract:-** In recent years, China's economy is developing rapidly, and its dependence on natural gas energy is also increasing. Russia has vast natural gas resources, is one of the world's leading exporter of natural gas. In the 21st century, China and Russia has closely cooperation in the political, economic, energy and military, energy trading has become an important part of trade between the two countries. In 2014, both countries signed the Russia-China cooperation in the east gas project memorandum, this is undoubtedly laid a solid foundation for developing natural gas trade between the two countries. The Russia - China trade for the study of natural gas, aimed at identifying the many factors affecting the size of the gas trade between China and Russia and its impact, with a view to proposing for healthy development of Russia-China natural gas trade targeted policy recommendations. Firstly, this article analyzes the current situation of natural gas and trade cooperation between China and Russia in economic and non-economic and found major problems in the development of bilateral trade. And by building a natural gas gravity model of trade between China and Russia, with 2006-2018 years of natural gas and trade cooperation between China and Russia data, empirical study on the influencing factors to determine whether and to what extent the effects of the Influence Factors of Russia-China natural gas trade.

The Empirical results show that China's economy is the most significant impact on the natural gas trade between China and Russia. China's economy, population size, regional economic cooperation on natural gas trade between China and Russia have positive effects, but geographical distance between the two countries, exchange rates have the negative effects. Therefore, China and Russia should strengthen regional economic cooperation, promote sustainable healthy growth of trade between China and Russia for natural gas.

**Keywords:-** China-Russian Cooperation; Natural Gas Trade; Gravity Model of Trade; Trade Influence Factors.

## I. INTRODUCTION

The China-Russian energy cooperation is an important part of Russia and China relations, geopolitical relations and bilateral trade. Natural gas is a high-quality and efficient green energy. Whether it is used in industrial fuel, power generation or civil gas, it is an important chemical raw material. From the perspective of national energy structure, the development and utilization of natural gas can reduce environmental pollution, provide sufficient energy and chemical raw materials, and optimize energy structure. At the same time, it can realize the sustainable development of environment and economy. Russia is the world's largest natural gas reserve and exploitation country, while China, as a developing country, has a huge demand for natural gas. Since the 1990s, China and Russia have discussed their cooperation in the field of natural gas. In recent years, many significant changes have taken place in the global energy market. Russia and China have been negotiating on energy cooperation and achieved phased results. In 2014, the two countries signed the memorandum of Russia-China East gas cooperation project, which further determined the 30-year contract time limit between Russia and China, and determined that from 2019, Russia will supply China with an annual average of 38-60 billion cubic meters of natural gas according to China's demand. Moreover, Russia and China have a deep friendship. Based on the above, the natural gas trade cooperation between Russia and China has unique advantages, and the cooperation between the two countries is inevitable.

In recent years, with the globalization of the world economy, China's economic development is very fast, but due to the excessive use of coal and oil, China's environmental pollution has attracted the world's attention. Under the pressure of the international community to protect the environment, China must consider adjusting its energy structure and promoting cleaner energy. As a clean energy, natural gas is the main energy that China can consider. At present, the increasingly frequent conflicts in the Middle East have brought a great threat to China's energy supply. Therefore, China needs to find stable and reliable energy suppliers. Cooperation with Russia is conducive to the stable and safe supply of energy in China, which is of great practical significance. Through the analysis of the factors affecting the natural gas trade between Russia and China and the study of the countermeasures, this paper not only makes clear the reality of the natural gas trade cooperation between Russia and China, but also provides reference and basis for the cooperation between the two countries. From

the theoretical point of view, it not only enriches the research contents of the relevant fields of Russia and China, but also promotes the development of the natural gas trade theory, provides more valuable information for the research of the natural gas trade field between Russia and China, and also provides certain theoretical basis.

## II. THE ECONOMETRIC ANALYSIS OF THE FACTORS INFLUENCING THE NATURAL GAS TRADE BETWEEN RUSSIA AND CHINA

### A. Introduction to trade gravity model

Trade gravitation model is a kind of econometric model based on Newton's gravitation theory and Newton's law, which introduces variables related to international trade. In Newton's law of gravitation, the mutual gravitation of two objects is directly proportional to the mass of two objects and inversely proportional to the square of the distance between two objects. The expression is as follows:

$$F_{ij} = G \frac{M_i M_j}{D_{ij}^2} \quad (1)$$

Where,  $F_{ij}$  represents the magnitude of gravity;  $G$  is the gravitational constant;  $M_i$  and  $M_j$  represent the masses of  $i$  and  $j$ ;  $D_{ij}$  represents the distance between  $i$  and  $j$ .

In the 1960s, Tinbergen (1962) and Pyhonen (1963) applied the gravity model to the research field of international trade. Their research believed that the total amount of bilateral trade between the two countries was in direct proportion to the economic scale of the two countries and in inverse proportion to the distance between the two countries. At the same time, the economic scale reflects the potential supply capacity of the exporting countries and the demand capacity of the demanding countries. The distance between the two countries is the obstacle to the trade between the two countries. The standard form of the initial trade gravity model is as follows:

$$M_{ij} = \alpha GDP_i GDP_j \quad (2)$$

Among them,  $M_{ij}$  represents the bilateral trade volume between the two countries;  $GDP_i$  and  $GDP_j$  represent the economic aggregate of country  $i$  and country  $j$  respectively;  $D_{ij}$  represents the geographical distance between the two countries, generally expressed by the straight-line distance between the capitals or important trade ports of the two countries;  $\alpha$  represents the constant term.

Take natural logarithm at both ends of formula 2 and convert it into linear form:

$$\ln M_{ij} = \alpha \ln(GDP_i GDP_j) - \alpha \ln(D_{ij}) \quad (3)$$

$$\ln M_{ij} = \alpha \ln(GDP_i) + \alpha \ln(GDP_j) - \alpha \ln(D_{ij}) \quad (4)$$

$$\ln M_{ij} = \beta_0 + \beta_1 \ln(GDP_i) + \beta_2 \ln(GDP_j) + \beta_3 \ln(D_{ij}) + \mu_{ij} \quad (5)$$

Among them,  $\beta_0$  is a constant term,  $\beta_1$ ,  $\beta_2$  and  $\beta_3$  are constants to be estimated, and  $\mu_{ij}$  is a random error term.

In the later research, scholars in different countries have modified the model to different degrees according to different research objects. Among them, in the field of international trade, according to the understanding of international trade, scholars from all countries introduce the influencing factors (i.e. explanatory variables) that affect the bilateral international trade flow into the trade gravity model, constantly enrich and optimize the trade gravity model, making the trade gravity model more suitable for the actual international trade situation.

For example, Linnemann (1966) thinks that population is an important factor affecting market demand, so he thinks that population size should also be an explanatory variable in the trade gravity model; Frankel (1997) adds virtual variables such as common border, common language and whether they belong to a free trade area on the basis of the standard form of the trade gravity model; Silvio H.T.Tai and Thierry Mayer (2007) studied the influence of economic scale, geographical distance, common border, common language, colonial relations, preferential trade policies and other factors on bilateral trade by using trade gravity model. After years of development, the trade gravity model has been enriched and expanded on the basis of the standard form, and gradually formed a more complete form:

$$\ln M_{ij} = \beta_0 + \beta_1 \ln(GDP_i) + \beta_2 \ln(GDP_j) + \beta_3 \ln(POP_i) + \beta_4 \ln(POP_j) + \beta_5 \ln(D_{ij}) + \beta_6 AD_{ij} + \mu_{ij} \quad (6)$$

Among them,  $POP_i$  and  $POP_j$  represent the population size of country  $i$  and country  $j$  respectively;  $AD_{ij} = 0$  or  $1$ , which is a variety of virtual variables (such as common border, common language, preferential trade policy, etc.);  $\beta_1$ ,  $\beta_2$ ,  $\beta_3$ ,  $\beta_4$ ,  $\beta_5$ ,  $\beta_6$  are estimated constants.

### B. The construction of gravity model of natural gas trade between Russia and China

Although the introduction of more explanatory variables will make the trade gravity model more in line with the reality of international trade, the more explanatory variables are introduced, the more theoretically it will deviate from the trade gravity model. Therefore, according to the new trend of bilateral trade between Russia and China in the post financial crisis period, on the basis of the theory of trade gravity model, by analyzing the actual situation of trade cooperation between the two countries, we can reasonably increase or modify the relevant explanatory variables, so as to build a new expansion of Trade Gravity Model in line with the actual trade between the two countries. At present, the trade gravity model mainly studies the per capita GDP, political mutual trust, regional institutional arrangements, average tariff rates and the impact of financial crisis on the development of bilateral trade.

In the gravity model, several variables represent several kinds of trade cost. For example, in the trade between landlocked countries and other countries, the dummy variable is generally used to represent the cost incurred as the distance between the two countries changes.

In this paper, gravity model will be used to analyze the influencing factors of natural gas trade between Russia and China. The total trade balance formula will use the following equation:

$$\ln M_{ij} = \beta_0 + \beta_1 \ln(GDP_{it}) + \beta_2 \ln(GDP_{jt}) + \beta_3 \ln(POP_{it}) + \beta_4 \ln(POP_{jt}) + \beta_5 \ln(ER_{jt}) + \beta_6 \ln(f_{it}) + \beta_7 \ln(D_{ij}) + \beta_8 \text{border} + \beta_9 AD_{ij} + \mu_{ij} \quad (7)$$

GDP<sub>it</sub> is the total GDP of country i in time t; GDP<sub>jt</sub> is the total GDP of country j in time t; POP<sub>jt</sub> is the total population of country j in time t; POP<sub>it</sub> is the total population of country i in time t; ER<sub>jt</sub> is the exchange rate of country j in time t; fit is the inflation rate of country i in time t; DIJ is the distance between country i and country j; border is whether the two countries are connected Using dummy variable); AD= 0 or 1, which is various dummy variables (such as common border, common language, preferential trade policy, etc.); μ<sub>ij</sub> is random error item; β<sub>1</sub>, β<sub>2</sub>, β<sub>3</sub>, β<sub>4</sub>, β<sub>5</sub>, β<sub>6</sub>, β<sub>7</sub>, β<sub>8</sub> are constant to be estimated.

C. Sources of samples and data

This paper selects the trade data between Russia and China from 2006 to 2018 for research. All the data in this paper are from the public data, through the collection and collation of the data, data validation. The balance of trade between the two countries is sorted out through the Statistical Yearbook published by the National Bureau of statistics every year, and the GDP and population of the two countries are sorted out through the global economic outlook report issued by the world bank. Inflation rate and other data. The exchange rate comes from the statistical yearbook of the National Bureau of statistics. And using the above data to calculate the per capita GDP, the ratio of exports to GDP, and the ratio of imports to GDP.

In this paper, Eviews 6.0 software is used to detect the model data and obtain the final results. Because the fixed effect method can't calculate variables that don't change with time. Therefore, in the fixed effect calculation method, Dist and Border variable coefficients are not included. The random effect method can calculate variables that do not change with time. In view of this advantage of random effect calculation method, this paper uses random effect method.

III. EMPIRICAL RESULT

A. Empirical test

The empirical test process of this paper is to bring the data of natural gas trade between Russia and China in 2006-2018 into the model and use Eviews 6 software for regression analysis. According to the regression results, select the appropriate individual random effect model; then remove the non-significant variables from the first regression results, then carry out regression, repeat the above steps until all explanatory variables in the whole model pass the t-test at the significance level of 0.05; finally, analyze the economic significance of each variable in the regression model. In this paper, we use formula 7 to make regression analysis of all data, then eliminate the variables that are not significant in T statistics, and repeat the above steps for the remaining variables until all the remaining variables in the model pass the t-test at the significant level of 0.05. Using the natural gas trade data of Russia and China from 2006 to 2018, nine explanatory variables are introduced by using the trade gravity model (formula 7). The first regression results are as follows:

Variables	Coefficient estimate	T-stat
C	-4.285	-1.856
ln(GDP <sub>it</sub> )	0.735	6.238*
ln(GDP <sub>jt</sub> )	0.012	1.812
ln(POP <sub>it</sub> )	0.558	3.218*
ln(POP <sub>jt</sub> )	0.212	0.472
ln(ER <sub>jt</sub> )	-0.273	2.208*
ln(f <sub>it</sub> )	-0.231	0.688
ln(D <sub>ij</sub> )	-0.481	2.635*
border	0.311	2.269*
AD <sub>ij</sub>	0.144	2.428*

Note: \* indicates that the estimated value of coefficient is significant at 5% significance level.

Table 1:- First Test Results of the Model

From the initial results of the model, the goodness of fit of the model is good, in line with the expected estimates. The final test results are as follows:

Variables	Coefficient estimate	T-stat
C	-3.218	-2.322
In(GDP <sub>it</sub> )	0.713	6.479*
In(POP <sub>it</sub> )	0.515	3.288*
In(ER <sub>jt</sub> )	-1.124	2.218*
In(D <sub>ij</sub> )	-0.436	2.741*
border	0.231	2.321*
AD <sub>ij</sub>	0.132	2.281*

Note: \* indicates that the estimated value of coefficient is significant at 5% significance level.

Table 2:- Final Inspection Results of the Model after Variables are Removed

After eliminating three insignificant variables, the final estimation results of the gravity model of Russia-China natural gas trade are obtained. From the test results in table 2, it can be seen that the fitting results of the trade gravity model to the natural gas trade data between Russia and China are good, the model generally passes the F test, the parameter estimation results are also relatively ideal, and all variables pass the significance test. Among them, the exchange rate and the geographical distance between the two countries hinder the natural gas trade between Russia and China; the level of China's economic development, the size of China's population, the border between the two countries and the two countries are SCO member countries, all of which promote the natural gas trade between Russia and China, basically in line with expectations.

#### B. Interpretation of empirical results

First, the regression coefficient of China's GDP, as the core explanatory variable in the trade gravity model, is 0.713, which has the most significant impact on Russia-China natural gas trade. For every 1% increase in China's GDP, it will promote the growth of natural gas trade by 0.713%. Previous studies have shown that when a country's bilateral trade scale is greatly affected by trade on its GDP, it indicates that the country's foreign trade structure is still at a low stage, and its export products are mainly resource and labor-intensive products; when a country's bilateral trade scale is greatly affected by trade on its per capita GDP, it indicates that the country's foreign trade structure has developed to a high stage. In choosing explanatory variables, this paper has explained the reasons why GDP and population size are used to test. From the final test results, China's GDP and population size have a significant impact on Russia-China natural gas trade. This conclusion is also in line with the reality of Russia-China trade structure.

Second, as an obstacle to the scale of bilateral trade, the role of geographical distance should not be ignored. In the process of testing, this paper also tests the absolute distance and relative distance of the two countries. Because traditionally, "absolute distance" has been used to measure the distance between two countries, that is, the distance between the political or economic centers or major ports of the two countries. However, in recent years, some scholars have proposed to replace the measurement of "absolute distance" with "relative distance", which represents the

transportation cost, that is, the ratio between the distance between two trading partners and the distance between them and other trading partners. In this paper, the validity of absolute distance and relative distance is tested in the analysis. The results show that the regression coefficient of the latter is less significant. Therefore, the final choice of regression coefficient is absolute distance.

Thirdly, the regression coefficient of the fictitious variable SCO is 0.132, which is consistent with the expectation through the significance test, indicating that Russia and China belong to APEC and Shanghai Cooperation Organization, which is conducive to the natural gas trade between the two countries. It can be seen that these two organizations have played a positive role in promoting the import and export trade of the two countries in reducing the bilateral trade resistance. One belt, one road policy, which is a policy variable, reflects the influence of trade policy factors. The SCO has a significant impact on the bilateral trade. It shows that various organizations including the Chinese government and relevant preferential policies play an important role in promoting the development of Russia-China natural gas trade.

#### IV. CONCLUSION

China is the third largest natural gas consumer in the world, and its natural gas production cannot meet China's demand. Therefore, import of natural gas is an important means for China to achieve the balance of supply and demand. Russia is a big exporter of natural gas, ranking first in the world. The natural gas trade cooperation between the two countries has a good foundation. It is necessary to study the current situation and influencing factors of the natural gas trade cooperation between the two countries to ensure China's natural gas security. Based on the analysis of the current situation of the natural gas trade between Russia and China, this paper theoretically analyzes the factors that affect the natural gas trade between Russia and China on the basis of economic factors and non-economic factors, then makes an empirical analysis, and finally puts forward suggestions to promote the natural gas trade between Russia and China.

This paper holds that although there are many factors influencing the natural gas trade between Russia and China, such as economic development level, per capita income level, trade openness, the proportion of China's natural gas consumption in production, natural gas trade price and so on, non-economic factors include Russia and China's energy policy, the game between Asia Pacific natural gas demand countries, the impact of Ukraine crisis, and legal environment Environmental factors, China's threat theory, US shale gas reform, etc., but the prospect of cooperation is still very broad, mainly due to the necessity and feasibility of Russia-China natural gas trade cooperation. At the same time, there will be a new Silk Road Economic Belt plan in the future, which provides financial guarantee for Russia-China natural gas project and the opportunity for Russia to start to implement the diversification of natural gas export market. However, in the process of cooperation, Russia and China still need to take corresponding measures to strengthen natural gas trade.

#### *A. Enhance mutual trust and cooperation between Russia and China*

Mutual trust and cooperation are an important factor for the rapid development of Russia-China oil and gas trade. However, due to the differences in interest demands of Russia-China oil and gas trade, and the level of mutual trust and cooperation between the two governments is far from ideal, which is also the reason why the laying of Russia-China oil pipeline and the determination of natural gas price have not been solved. Therefore, the governments of Russia and China should actively work to enhance consensus, strengthen cooperation between the two countries, and strive to find the convergence points of interest demands of oil and gas trade between the two countries, so as to jointly establish a good political foundation for the development of oil and gas trade between the two countries. At the same time, the two governments should make mutual understanding and accommodation, achieve win-win results through cooperation, strengthen cooperation in new energy, new technology and other fields, and make joint efforts to establish good oil and gas trade cooperation between the two countries.

As two of the world's great powers, it is necessary for Russia and China to establish a long-term and stable oil and gas cooperation relationship. The establishment of trade relations not only makes Russia and China become strategic partners in politics, but also makes great contribution to the healthy and rapid economic development of the two countries. However, restricted by the attitude of the two governments, the trade cooperation between the two countries has been hindered repeatedly in recent years, which has brought a negative impact on the oil and gas trade between Russia and China, so it is very important to increase mutual trust between the two countries. No matter political exchanges or cultural exchanges between people, only continuous exchanges between Russia and China can increase mutual understanding, further strengthen mutual trust between Russia and China, make China know Russia better and make Russia know China better. China's demand for oil and gas has been increasing, and domestic supply

cannot meet the demand. Therefore, it is very necessary for Russia and China to trade in oil and gas, which is also conducive to the common development of Russia and China.

Because the oil and gas trade between Russia and China has not reached the ideal level, there are many concerns on both sides, resulting in the failure of China's two investments in Russian oil, and the signing of a large natural gas bill only after more than ten years, and the Russian Chinese plan to build oil and gas pipelines was once stranded. The obstacles in the oil and gas trade between Russia and China are due to the mutual 's distrust. Therefore, the establishment of mutual trust is the premise of promoting oil and gas trade between Russia and China. Russia and China should fully cooperate, deepen mutual understanding, carry out extensive diplomatic activities and strengthen friendly exchanges between Russia and China. In recent years, Russia and China have continuously developed their comprehensive strategic partnership of cooperation. At present, Russia-China relations are far better than before, and cooperation in energy, economy and trade, security and other fields has made positive progress. On the issue of oil and gas trade, Russia and China have made great efforts through long-term negotiations. From this process, we can see the development of Russia-China relations and the achievements of Russia-China comprehensive strategic partnership of cooperation. Therefore, China should strengthen the level of regional economic cooperation with Russia, embody the sense of community of common destiny in the regional cooperation between the two countries, mobilize the enthusiasm of all departments of the two governments, continuously strengthen exchanges and cooperation in all fields of the two countries, and establish more stable cooperative relations.

#### *B. Further deepen Russia-China natural gas trade cooperation*

At present, Russia and China have not established a natural gas cooperation mechanism. In order to ensure the long-term cooperation between the two countries and prevent emergencies in the process of cooperation, the natural gas cooperation between the two countries is hindered. From the experience of energy cooperation between Russia and other countries, the standards of cooperation between Russia and each energy demanding country are not completely the same, and Russia has not established an energy cooperation mechanism with other energy demanding countries, so there will be irregularities in the process of cooperation, which will lead to unhappiness of cooperation between the two sides. According to Reuters, Russia may postpone the completion of the East pipeline project to the completion of the West Pipeline Project. China should be vigilant, take necessary measures to avoid this, establish a natural gas cooperation mechanism, and standardize the natural gas cooperation between the two sides. The fundamental reason for the signing of the natural gas transportation contract between Russia and China is that due to the changes in the energy foreign policies of both sides, Russia's natural gas foreign policies may change again in the future. In order to ensure the natural gas cooperation

between the two countries, China should strive to promote a standardized natural gas cooperation mechanism, reduce the risk of cooperation, and ensure the safety of China's natural gas supply.

With rapid economic development, the Asia Pacific region is the region with the fastest growth in natural gas demand. Represented by China, Japan and South Korea, natural gas is highly dependent on foreign countries. In the Asia Pacific region, Russia is the largest natural gas supplier, and China, Japan and South Korea are natural gas demanders. The three countries are actively seeking natural gas cooperation with Russia, which will inevitably lead to competition. Russia sees its interests from this, and its energy policy is to adopt bilateral natural gas cooperation with countries in need. China should take the Asia Pacific region as a region, establish a cooperation mechanism among energy demand countries, turn bilateral cooperation into multilateral cooperation, and try to avoid competition among demand countries.

#### *C. Establish the price mechanism of natural gas trade between Russia and China*

The most crucial factor in the cooperation of natural gas trade is the price, which cannot be discussed. Even more preparations are in vain. What is the standard of the contract price of both parties and how to solve the price problem need an open and transparent price mechanism for both parties. If Russia and China want to achieve mutual benefit and win-win results, they should not only focus on their own interests, only on the price, but also find a suitable point of agreement so that both sides can accept it. The establishment of a price mechanism can also better constrain both parties to the contract and provide more guarantee for the implementation of the contract between both parties. When establishing the natural gas price mechanism, we should also pay attention to the changing trend of natural gas price in the world natural gas market, the cost of natural gas development, the cost of pipeline construction of both parties, and comprehensively consider all factors to establish a reasonable and effective natural gas price mechanism.

#### *D. Strengthen cooperation between Russia and China natural gas enterprises*

Natural gas companies of Russia and China are the main body of natural gas trade between the two countries. The government plays a more guiding role in the natural gas cooperation between the two countries, and enterprises play a more important role. The two countries should strengthen exchanges between enterprises and carry out more meetings and forums in the fields of technology, exploration and other cooperation. At present, the way of natural gas cooperation between the two countries is relatively single. The two governments should encourage enterprises to seek more ways of cooperation so as to deepen cooperation between the two countries. However, from the perspective of China, it is not a simple thing to participate in the field of joint exploration and development of natural gas. Chinese enterprises should make more preparations for expanding the field of natural gas cooperation between the two countries, have a more thorough and clear understanding of

Russia's national and enterprise level strategic planning, and constantly pay attention to the natural gas policies of Russia's national and local governments. Changes in order to make timely adjustments. Chinese enterprises should also strengthen their ties with Russian enterprises and actively seek the possibility of cooperation in Russia's upstream natural gas market. Of course, when dealing with Russian enterprises, it is necessary to have a clear understanding of local laws and regulations, systems, etc., so as to avoid increased resistance to cooperation.

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