Master Thesis

Analyzing the Bilateral Trade between Uzbekistan and its trade partners: A Gravity Model Method

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Major in International Trade and Economic

Dept. of International Trade and Economic

Sattorov Abrorjon Abduvannobovich

Master Thesis
Advisor Professor Yoonkyo Cho

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Abstract

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This paper aims to analyze the bilateral trade between Uzbekistan and its main trade partners and neighboring countries. In order to do so, a gravity model analysis trade between Uzbekistan and its trade partners over a period of 29 years, from 1991 to 2019 was conducted. The regression results confirmed the basic assumptions of the gravity model and indicate that the GDP of trade partners of Uzbekistan has a positive influence on the bilateral trade volume. The population of partners also has a positive effect on bilateral trade. And the degree of logistic performance index (LPI) has a main role in promoting the development

of bilateral trade flows. In particular, the LPI of Uzbekistan has a positive effect on bilateral trade flows. The trade development Uzbekistan is facing many problems such as poor logistic systems and transportation structure as well as imbalanced payments. The result of this paper provides for Uzbekistan trade policy and future planning. High logistic costs and low-quality logistic services may have negative influences on the trade flows. A better logistic performance has more opportunity to attract foreign direct investors and international trade ability.

【Keyword】 Bilateral trade, Logistic Performance index, Gravity model, Uzbekistan.

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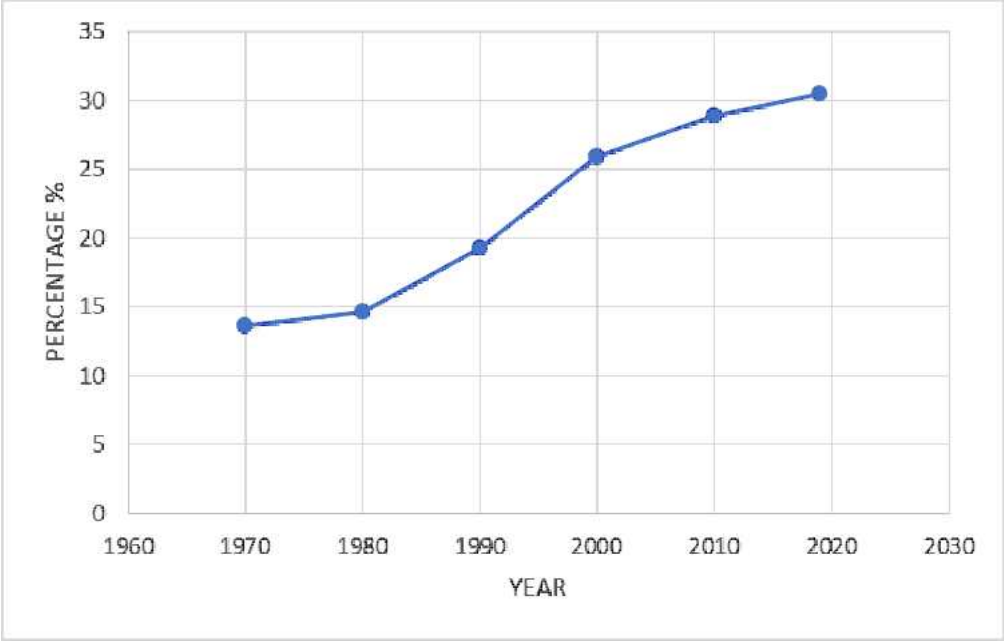
Chapter I. Introduction

1.1 Background

Foreign trade has a main role in international trade. Most people can imagine that "Trade" is important in people's daily life. International trade between two or more countries is also an important way for raising living standards. Nowadays international trade has become increasingly important with a greater share of GDP devoted to exports and imports. According to the World Bank, exports as a % of GDP had increased from 12% in 1960 to around 30 % in 2018.

Table 1. World exports as a percentage of GDP

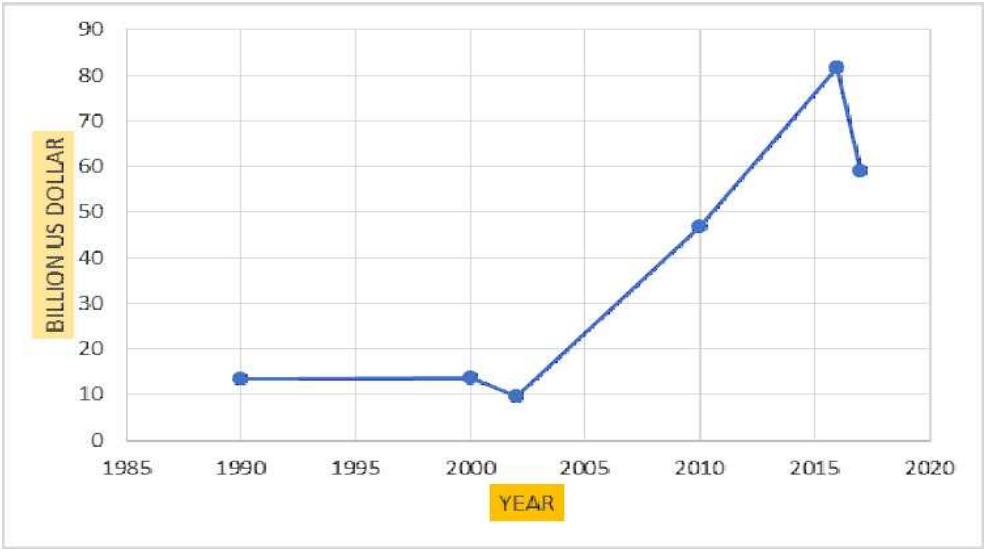


(Source: data.worldbank.org)

Foreign trade has become the main part of Uzbekistan's total GDP during the last twenty years. In macroeconomic terms, Uzbekistan's total

exported goods represent 3.4% of its overall Gross Domestic Product for 2018 (250.3 billion US dollars). Against all predictions, Uzbekistan's economy returned to growth in the late 1990s, averaging a rate of 4 % from 1997 onwards. By 2002, the country's GDP was slightly higher than it had been in 1989, making Uzbekistan the first former Soviet Union Republic to regain its pre-independence levels. The Gross Domestic Product (GDP) in Uzbekistan was worth 59.15 billion US dollars in 2017. The GDP value of Uzbekistan represents 0.08 percent of the world economy. GDP in Uzbekistan averaged 26.96 USD Billion from 1990 till 2017; the highest was 81.77 billion US dollars in 2016 and the lowest was 9.69 billion US dollars in 2002.

Table 2. GDP of Uzbekistan



(Source: data.worldbank.org)

Global exchange is the trading of wares, items, administrations, capital among individuals and organizations in various nations. International trade has existed for a long time, but trade has increased hugely in the

past few hundred years and has a major impact on the economies of many countries (James, 2014). Because of this, it is especially important to analyze and monitor the factors which can influence international trade. In figure 1, the main international trader countries are explained.

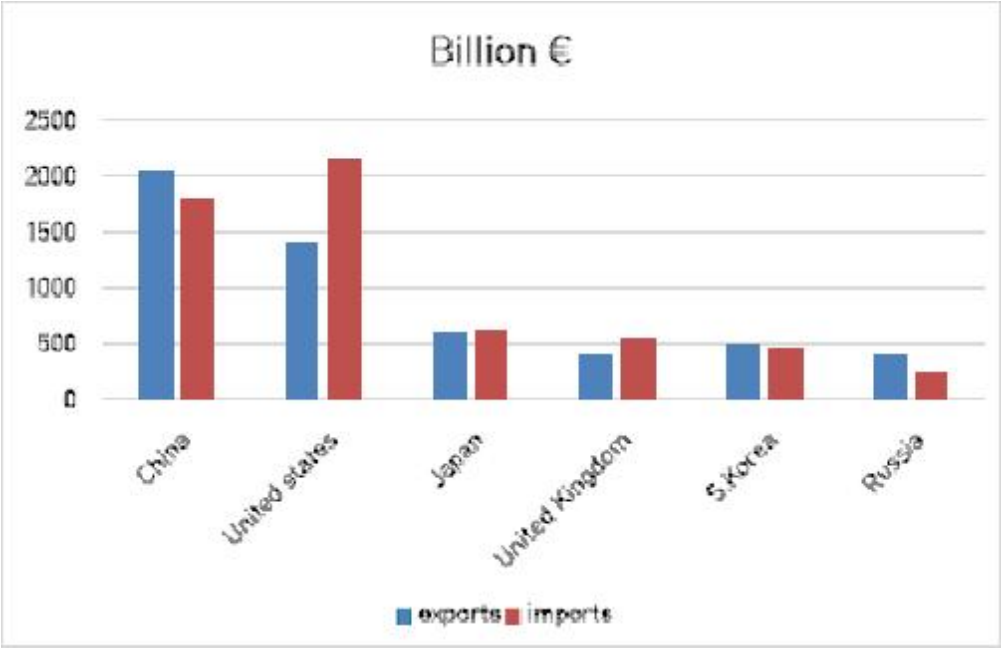


Figure 1 Main players for international trade in 2018 (billion EUR) according to Eurostat

Doing bilateral trade with main trade partners and neighboring countries of Uzbekistan may cause an increase to foreign trade flow rates. As a result, Uzbekistan's GDP estimation may go up a level too. So, this paper aims to analyze the bilateral trade flows between Uzbekistan and its neighboring countries and main trade countries too. Two reasons out of several are given for choosing bilateral trade with China, Russia, Kazakhstan and Kyrgyzstan.

Firstly, the estimation lists which are: "The top export destinations of Uzbekistan" and "The top import origins" shows China at the top. It means that China is one of the main trade partners of Uzbekistan. The next top trade partner of Uzbekistan after China is Russia. In 2018, Uzbekistan exported more than one billion US dollars in goods to Russia while Russia exported almost 2.63 billion US dollars in goods to Uzbekistan. It means that Russia is one of the main trade partners of Uzbekistan.

Table 3. The main trade partners of Uzbekistan (2018)

N	Export destination	US dollars	Import origin	US dollars
1	Switzerland	3,68 billion	China	2,72 billion
2	China	1,4 billion	Russia	2,62 billion
3	Russia	1,01 billion	Kazakhstan	1,25 billion
4	Turkey	815 million	South Korea	1,18 billion
5	Kazakhstan	714 million	Turkey	1 billion

Source: The State committee of Uzbekistan

The next reason is the geographical location. Uzbekistan is uniquely dependent on cross- border linkages, as one of just two double landlocked countries in the world.[1] It means that exported goods from Uzbekistan cross at least two other countries to get there (see

1) The only other doubled landlocked country is Liechtenstein.

transportation). So, it is very hard to use low-cost transportation. Trade between neighboring countries has big advantages for the landlocked country. If "The Great Silk Road" project is completed, this gives a greater opportunity to transfer goods from Uzbekistan to China and from China to Uzbekistan. Kyrgyzstan is situated between Uzbekistan and China. Kazakhstan is also between Russia and Uzbekistan. Main strategically placed railways also connect with Kazakhstan. Logistics allow you to dramatically reduce the time interval between the delivery of raw materials and semi-finished products and the delivery of finished products to the consumer. This in turn helps to increase economic efficiency. First, it is necessary to create a logistics system depending on the geographical conditions of Uzbekistan that will allow the economy of Uzbekistan to dramatically increase the efficiency of processes.

The gravity model has been famously used in international trade research. This paper also aims to analyze the bilateral relationship between Uzbekistan and five partner countries with the help of the gravity model. In this paper the "Gravity- model" is used to answer the research question: "What kind of factors may affect Uzbekistan's bilateral trade flows with China, Kazakhstan, Kyrgyzstan and Russia?" after taking the linear regression's result one can obviously answer the questions below too:

- Do the two players have a strong effect towards the bilateral trade between both parties, when the distance has an impact on bilateral trade flows?
- Finding the impact of population on bilateral trade?

- How Uzbekistan's total GDP affects bilateral trade flows?
- Is there any influence of total logistic performance index on the bilateral trade of Uzbekistan?
-

This paper plans to research previous factors and some other determinants too.

The regression of this paper is run on the gravity model method, using "STATA /IC 14.2" software for multiple linear regressions.

The data set out in this paper is going to be panel data, and the time period includes 29 years from 1991 to 2019. During the process of writing, it is expected to use data resources below: UN Comrade, Word Bank, Google Map, Official website of WTO, WITS statistics, official statistics of Uzbekistan, International Monetary Fund data, etc.

1.2 Motivation

It is a fact that bilateral trade flows are an especially important economic indicator, which is used more by economists, future planners and policy makers. Bilateral trade flows show the finished goods and services that have been exported from one country to another, while it represents the value of imported goods and services which have been imported from one country to another too. That is why it may change international trade policy and domestic economic policy as well in both parties. For instance, a developing country that exports from Uzbekistan to a trade partner country would change the partner's trade balance. As a result, the partner's economy needs to cover the financial shortfall created by this increased outflow of money to Uzbekistan, while Uzbekistan will have some benefit from foreign assets by its partner.

So, above deficits and surpluses caused by international trade are major aspects for a country's economic increase. According to these, I considered that studying bilateral trade flows between Uzbekistan and its main partners is particularly important research for me. Trade is the basis of a country's economy. It is possible to boost the country's economy through the development of international trade. Logistics is a key part of international trade. Therefore, through the development of the structure of the logistics system, international trade, in turn, will push the country's economy to a higher level.

As we know, China, Russia and Kazakhstan are the main trade partners of Uzbekistan. So, it is remarkably interesting and important to study, test and search for new potentials in bilateral trade. This paper hopes to analyze trade relations between Uzbekistan and its four trade partners. Also, by making the gravity model to analyze the influencing factors of bilateral trade

of Uzbekistan and its trade partners is another purpose. Based on this, Uzbekistan can take advantage of favorable effects to promote bilateral trade. According to the regression result, this paper aims to figure out the influences on the trade between Uzbekistan and trade partners. After this, links with the current international market environment. Finally, providing a future market forecast and giving some trade policy guidance for Uzbekistan's trade planners.

1.3 Structure

This paper includes five chapters. In the first chapter, research background and research purposes are explained. The second chapter covers the international trade relations between Uzbekistan and trade partners. The third chapter is a literature review on the gravity model. The fourth chapter provides methodology and results from empirical analysis. The fifth chapter is the conclusion part which summarizes the full text and gives some suggestions about promoting bilateral trade relations.

Chapter 2 International trade relations between Uzbekistan and Trade partners

2.1 Economic and trade status between Uzbekistan and China

Uzbek Chinese cooperation is gaining momentum and strategic partnership is reaching a high level. These relations, which serve the national interests, socio-economic development and prestige of our countries in the world, are developing based on cooperation of mutual friendship and trust, initiated by the First President of the Republic of Uzbekistan.

The Treaty on Friendship, Cooperation and Partnership, signed in 2005, and the Joint Agreement on Comprehensive Deepening and Development of Friendship, Cooperation and Partnership, signed in 2005, provide a legal basis for mutually beneficial cooperation. Declaration, Joint Declaration on Strategic Partnership in 2012, Joint Declaration on Further Deepening and Development of Bilateral Strategic Partnership in 2013, Strategic Partnership Development Program for 2014-2018 and the Joint Statement signed in 2016.

The adoption of these documents is of great historical significance and scale. They serve to further develop relations between our countries in the long run.

The People's Republic of China is actively involved in the implementation of programs to modernize and diversify the Uzbek economy, expand the production of competitive products and increase the export potential of the industry.

Particular attention is paid to the development of long-term and mutually beneficial relations with leading industrial companies in the PRC, primarily high-tech industries. Joint projects in oil and gas and telecommunications,

transport, textiles, chemical industry and other areas are being successfully implemented. Chinese businesses have been involved in the construction of many new industrial projects in Uzbekistan, including the Dehkanabad Potash Fertilizer Plant and the Kungrad Soda Plant. With the support of Chinese entrepreneurs, the country has launched the production of electrical products, mobile phones and construction equipment. Huawei has implemented 20 projects for the development of telecommunications networks in Tashkent and the regions of Uzbekistan. Modems, smartphones and other devices produced in cooperation with ZTE are in high demand in domestic and foreign markets.

All four lines of the Central Asia-China gas pipeline pass through Uzbekistan. The National Oil and Gas Corporation of the People's Republic of China is actively involved in the exploration and development of promising hydrocarbon deposits in our country. The Mubarak Gas Chemical Complex is cooperating on deep processing of natural gas.

Uzbek Chinese relations - Since the territory of Uzbekistan is a crossroads of the Great Silk Road, trade and economic relations between the two countries have a history of several thousand years.

In 2018, the total foreign trade turnover of Uzbekistan amounted to 33429.9 million US dollars. Of this, exports amounted to 13990.7 million US dollars, while imports amounted to 19439.2 million US dollars.

Table 4. Indicators of foreign trade activity of Uzbekistan (Million US dollar)

Year	Total foreign trade volume	Export	Import
2010	22199.2	13023.4	9 175.8
2011	26365.9	15021.3	11344.6
2012	26416.1	13599.6	12816.5
2013	28269.6	14322.7	13946.9
2014	27530.0	13545.7	13984.3
2015	24924.2	12507.6	12416.6
2016	24232.2	12094.6	12137.6
2017	26566.1	12553.7	14012.4
2018	33429.9	13990.7	19.439.2

(Source: Annual statistical collection of the Republic of Uzbekistan, 2010-2018)

China is Uzbekistan's main trading partner. In 2018, China exported $3.78B to Uzbekistan. The main products exported from China to Uzbekistan were Coated Flat-Rolled Iron ($197M), Specialized Vehicles ($111M), and Stone Processing Machines ($107M). During the last 23 years the exports of China to Uzbekistan have increased at an annualized rate of 21%, from $47.4M in 1995 to $3.78B in 2018.[2]

[2] https://oec.world/en/profile/bilateral-country/chn/partner/uzb?dateAvailableSelectorCountry2=exportDateCountry2Available17

Table 5. Distribution of export-import relations of Uzbekistan with China
(Million US dollar)

Years	Total Export value of Uzbekistan from China	Total import value of Uzbekistan from China
2010	931.8	1 252.0
2011	1302.2	1 397.2
2012	1463.1	1 894.8
2013	2055.4	2 455.1
2014	2123.6	2 396.8
2015	2472.2	2 258.1
2016	1999.3	2 254.3
2017	2 025.5	2 728.7
2018	2 245.4	3 778.1

(Source: Annual statistical collection of the Republic of Uzbekistan, 2010-2018)

In 2018, Uzbekistan exported $2.24B to China. The main products exported from Uzbekistan to China were Petroleum Gas ($1.29B), Non-Retail Pure Cotton Yarn ($295M), and Refined Copper ($155M). During the last 23 years the exports of Uzbekistan to China have increased at an annualized rate of 16.6%, from $65.6M in 1995 to $2.24B in 2018.[3]

Table 6. The share of Uzbekistan in total exports with other foreign countries
(As a percentage of the total volume)

Country	2015	2016	2017	2018
Export to other foreign countries	58.2	64.1	67.5	64.2
Belgium	0.2	0.2	0.2	0.2
The UK	0.4	0.4	o.4	1,2
Germany	0.3	0.3	0.3	0.4
Israel	0.1	0.1	0.1	0.1
Italy	0.1	0.3	0.2	0.2
Iran	2.5	2.9	2.1	1.2
China	19.8	16.5	16.1	20.6
Korea Republic	1.4	1.7	1.1	0.8

[3] Data from BACI HS6REV.1992(1995-2018)

Latvia	0.3	0.5	0.7	0.3
Netherlands	0.1	0.1	0.1	0.1
UAE	0.4	0.5	0.4	0.5
USA	0.2	0.4	0.3	0.3
Turkey	6.3	5.7	7.0	6.8
France	1.2	1.0	1.2	1,4
Switzerland	0.1	0.2	0,1	0,1
Japan	0,1	0,1	0,1	0,1
Total	100	100	100	100

(Source: Annual statistical collection of the Republic of Uzbekistan, 2010-2018)

In 2018, China ranked 30 in the Economic Complexity Index (ECI 0.89), and 1 in total exports ($2.59T). That same year, Uzbekistan ranked 85 in the Economic Complexity Index (ECI -0.47), and 86 in total exports ($10.5B). In terms of GDP Per Capita, China was ranked 78 with a GDP Per Capita of $9,771, and Uzbekistan was ranked 160 with a GDP Per Capita of $1,532.

Table 7. The share of Uzbekistan in total imports with other foreign countries
(As a percentage of the total volume)

Country	*2015*	*2016*	*2017*	*2018*
Import to other foreign countries	65.2	66.6	64.3	63.3
Austria	0.6	0.9	0.5	0.5
Belgium	0.4	0.5	0.4	0.3
United Kingdom	0.6	1.2	0.8	0.4
Germany	3.9	4.1	4.2	3.7
Israel	0.2	0.2	0.2	0.2
Italy	1.2	1.4	1.1	1.4
Iran	0.5	0.5	0.4	0.7
China	18.2	18.6	19.5	18.3
Korea Republic	12.6	7.2	8.9	10.5
Latvia	1.1	2.0	1.5	2.0
Netherlands	0.6	0.5	0.5	0.7
UAE	0.6	1.6	0.5	0.4
USA	1.9	3.4	1.3	1.9
Turkey	3.3	4.0	4.8	5.7

France	1.2	1.2	0.8	0.6
Switzerland	0.7	1.3	1.1	0.8
Japan	2.0	2.0	1.1	3.5
Total	100%	100%	100%	100%

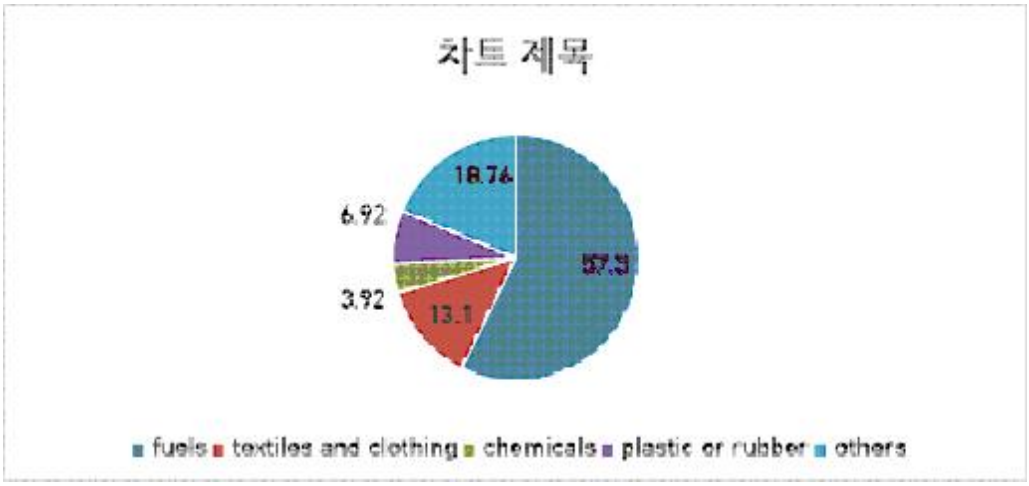
(Source: Annual statistical collection of the Republic of Uzbekistan, 2010-2018)

Uzbekistan's total population is about 32.96 million (2018), which means that Uzbekistan's population represents about a portion of the absolute population of Central Asia. Uzbekistan has abundant mineral resources and a relatively complete heavy industry system; moreover, in 2018 it was the second largest cotton exporter in the world.[4] Uzbekistan, the world's sixth-largest cotton producer, produced 2.3 million tons of raw cotton in 2018. Traditionally, cotton is Uzbekistan's most important cash crop. But in recent years the country has been taking serious steps to develop its textile industry to produce value-added products rather than exporting raw cotton. According to the statistics of the National Statistical Committee of Uzbekistan, the textile exports of Uzbekistan maintained a rapid growth in 2018. The annual export of textiles reached 1.6 billion U.S. dollars, up by 41.4 percent from the previous year.

[4] www.baijiahao.baidu.com

Figure 2. Commodity structure of trade between China and Uzbekistan (2018, %)

Uzbekistan export to China



(Source: National Statistical Committee of Uzbekistan)

Uzbekistan imports from China (2018, %)

(Source: National Statistical Committee of Uzbekistan)

It can be seen from Figure 2 that Uzbekistan's exports to China were

characterized by diversity: mineral products, textiles accounting for 57.3% and 13.1%, respectively; metals and chemical products accounting for 6.925 and 3.92%, respectively.

Main imports from China to Uzbekistan were electrical and mechanical products. This estimates forty percent of total imports in 2018.

2.2 Bilateral status of Uzbekistan and Kazakhstan

Uzbekistan is situated in the middle of Central Asia. Uzbekistan is bordered by Kyrgyzstan and Tajikistan to the east and southeast, Kazakhstan to the northwest and north, Afghanistan to south, and Turkmenistan to the southwest. If we see the map, we can easily see Kazakhstan is a long territorial neighbor of Uzbekistan. The distance from Tashkent to Astana is 1611.6 km long.

Figure 3. Map of the Central Asian Countries

(Source: Google Map)

Uzbekistan and Kazakhstan are important countries in Central Asia. Relations between the two countries are developing in the spirit of good neighborliness and strategic partnership. These partnerships are based on long-standing ties of friendship and brotherhood, common history, language and culture.

Uzbekistan is Kazakhstan's largest trading partner in Central Asia. The Strategy of Economic Cooperation between the Republic of Uzbekistan and the Republic of Kazakhstan for 2017-2019 is the basis for raising relations in this area to a new level. In March 2018, trade agreements and investment agreements worth about $1 billion were signed at a business forum in Astana with the participation of business circles of the two countries. Today, business structures of Uzbekistan and Kazakhstan put forward several proposals for the establishment of joint ventures, the opening of trading houses, and the implementation of promising and mutually beneficial investment projects. Specific goals have been set to increase bilateral trade to $5 billion.

Another important area of cooperation is the rapid integration of transport infrastructure of Kazakhstan and Uzbekistan, which plays a key role in the formation of transport and transit corridors, as well as conditions for stimulating trade and investment in Uzbekistan, creating conditions for further development of bilateral and regional cooperation. After the independence of Uzbekistan and Kazakhstan, bilateral trade flows increasingly developed. In 1995 total trade volume was 422.6 million US dollars. But total trade volume reached 2752.8 million US dollars in 2019. Figure 4 shows bilateral changes of Uzbekistan and Kazakhstan.

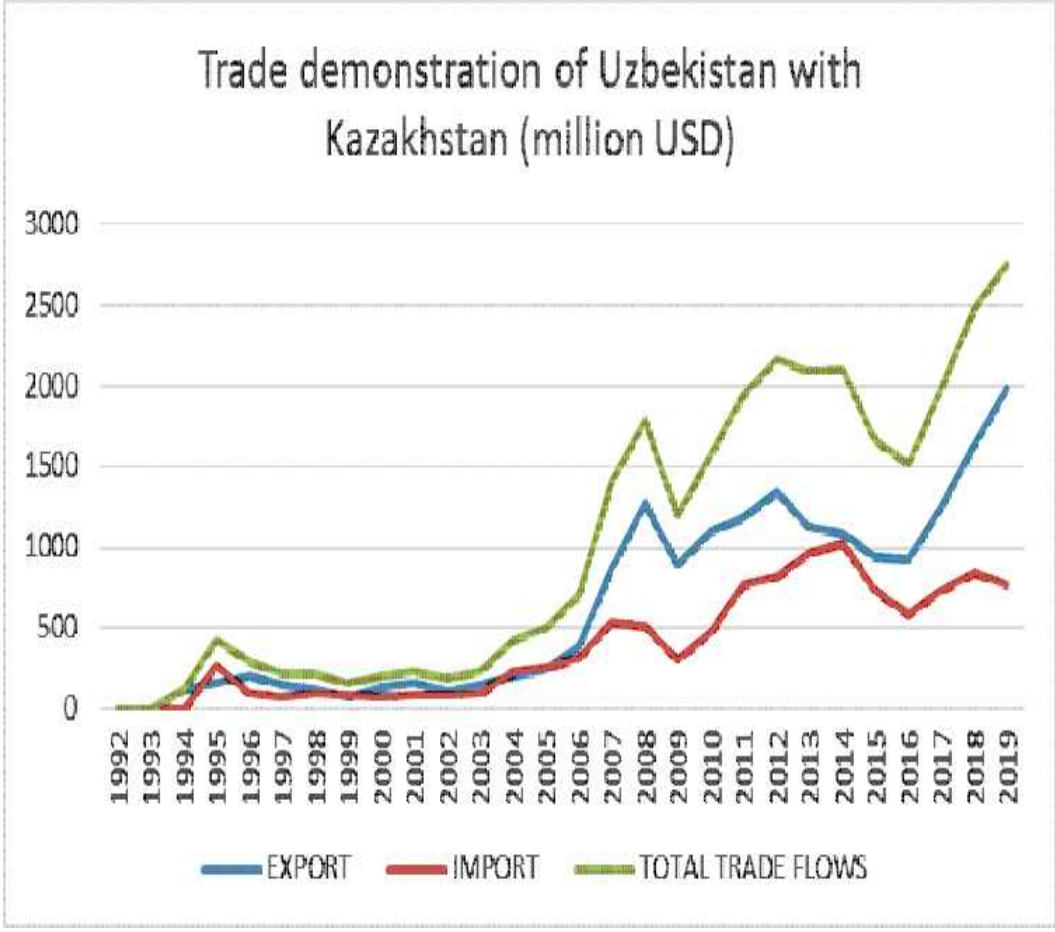


Figure 4. Total trade flows of Uzbekistan and Kazakhstan during 1991-2019. (Source: International Monetary Fund data)

2.3 International trade relations of Uzbekistan with Kyrgyzstan and Russia

Kyrgyzstan is another neighboring country of Uzbekistan. the capital of Kyrgyzstan is Bishkek. The distance from Tashkent to Bishkek is 633.6 km long. Constructive, multifaceted and mutually beneficial dialogue with the Kyrgyz Republic is one of the strategic directions of Uzbekistan's foreign policy. It is no exaggeration to say that in a noticeably short period of time, historic steps have been taken to strengthen and expand relations between the two countries. Bilateral relations are moving in a positive direction and are enriched with clear practical content. A memorandum of cooperation was signed between the Ministry of Foreign Trade of the Republic of Uzbekistan and the Ministry of Transport and Roads of Kyrgyzstan. Trade and economic ties have also significantly revived. For example, in 2016, bilateral trade increased by 23% to $167.5 million, while in the first half of 2017, the figure increased by 69% to $112 million.

Uzbekistan aims to further increase bilateral trade through the effective use of untapped potential and the expansion of the range of products with high added value. Soon, it is planned to increase bilateral trade turnover with the Kyrgyz Republic to $500 million. To this end, cooperation between the business circles of Uzbekistan and Kyrgyzstan is intensifying. For example, two business forums were held in Tashkent and Bishkek: 57 agreements worth $175 million were signed in Bishkek, and 17 agreements worth more than $200 million were signed in Tashkent. Figure 4 describes the total trade volume of Uzbekistan and Kirgizstan during the last 28 years. It shows that international trade between Uzbekistan and Kyrgyzstan has increased from time to time.

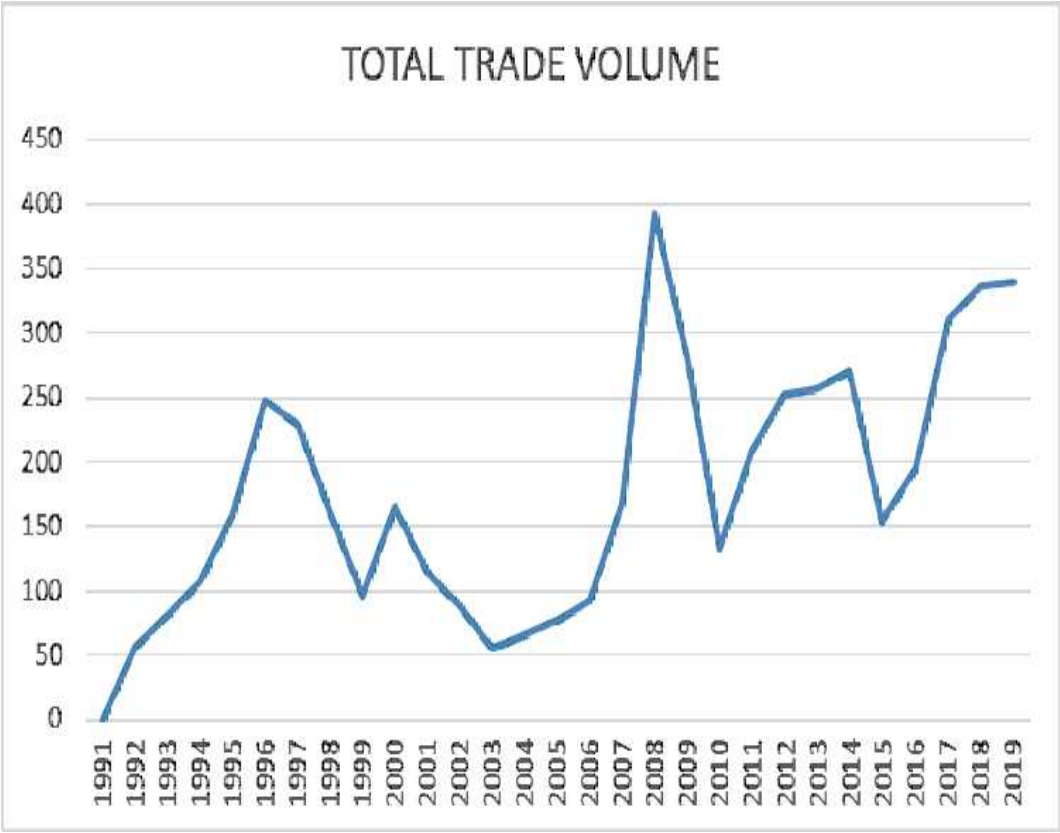


Figure 5. Total trade volume of Uzbekistan and Kyrgyzstan. (One unit: million USD)
(Source: International Monetary Fund data)

Russia is one of Uzbekistan's leading trading partners. Trade and economic cooperation play a key role in Uzbek-Russian relations. In accordance with the Program of Economic Cooperation for 2013-2017, the intergovernmental agreement on the main directions of development and deepening of economic cooperation in 2015-2019, relations in this area are developing steadily.

Uzbekistan exports to Russia natural gas, vehicles, ferrous and non-ferrous metals, knitwear, cotton fiber, fruits and vegetables, and various services.

Russia supplies Uzbekistan with vehicles, chemical and paper products, and food. 961 joint ventures with Russian businessmen operate in Uzbekistan. At the same time, 64 Russian companies have opened offices in Uzbekistan. 569 business entities with Uzbek partners have been established in the Russian Federation and are operating effectively.

The volume of bilateral trade is steadily growing. In recent years, this figure has doubled in agriculture. In the table below, international trade of Uzbekistan and Russia was given from 1992 to 2019 time periods.

Table 8. International trade flows between Uzbekistan and Russia (1994–2019)

Year	*Total export to Russia*	*Total import from Russia*	*Total trade volume*
1994	834	851,3	1685,3
1995	824,1	888,7	1712,8
1996	1082,963	651,9691	1734,932
1997	874,693	1015,672	1890,365
1998	484,764	521,096	1005,86
1999	240,0738	465,5419	705,6156
2000	274,4578	662,2162	936,674
2001	363,8436	579,8601	943,7037
2002	453,3535	341,6188	794,9723
2003	503,2378	480,405	983,6429
2004	766,9245	611,8506	1378,775
2005	860,5294	901,9973	1762,527
2006	1086,265	1289,68	2375,945
2007	1729,025	1463,82	3192,844
2008	2089,396	1308,506	3397,902
2009	1694,053	846,2677	2540,321
2010	1663,568	1513,478	3177,046
2011	1924,223	1148,151	3072,374
2012	2324,245	1390,822	3715,067
2013	2803,91	1256,885	4060,796
2014	3121,019	875,3067	3996,326
2015	2235,351	601,7587	2837,11
2016	1965,051	759,2313	2724,282
2017	2626,658	1025,373	3652,031
2018	3324,859	1061,882	4386,741
2019	3911,471	1168,222	5079,693

(Data source: International Monetary Fund data)

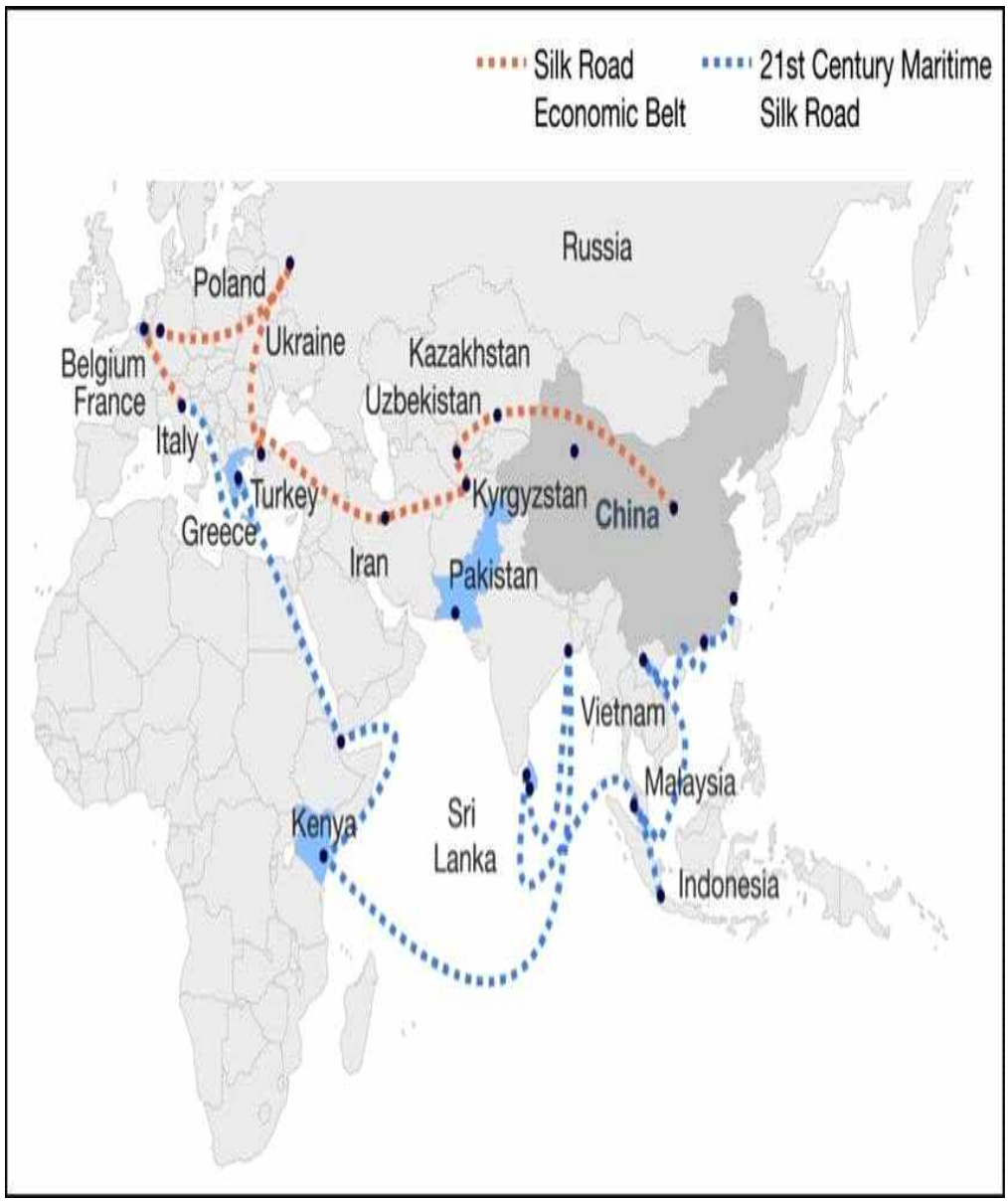
2.4 How does the “One Belt One Road” project affect bilateral trade between Uzbekistan and China?

As we know, in 2013, China announced a new economic development strategy called "One Place, One Way" in order to expand cooperation between the Eurasian countries. In this way, Chinese President Xi Jinping is implementing his idea of reviving the centuries-old Great Silk Road. The idea to create a new Silk Road was put forward by Xi Jinping on September 7, 2013. A month later, in a speech to the Indonesian parliament, he reiterated his views on the 21st century Great Silk Road. The idea has created positive competition between the country's regions.

Beijing's One Place One Way project covers 60 countries on three continents. The project starts in Xi'an, which currently has a population of 10 million. The Chinese see this city as the cradle of civilization. Xi'an, once the largest city on the planet, has served as China's capital for thousands of years.

As the new Strategy is implemented, new opportunities are emerging. Analysts say China has decided to expand cooperation with other countries as it pursues economic development. It is said that the faith of the New Silk Road is great. The new project, called the Economic Belt, will boost the region's economies and increase trade. The new Silk Road will allow China's provinces to establish economic cooperation with neighboring countries. At the same time, it will help create new markets for Chinese products. Through the New Silk Road, China will not only restore the ancient Silk Road, but also contribute to the creation of a new trade and economic model in the Eurasian region. That is, cooperation between the countries of the region will reach a new level.

Figure 6. The map of the One Belt One Road



Source: Mc Kinsey Company. www.mckinsey.com

The One Place One Road project connects Australia and Indonesia, Asia, Europe, Africa and Latin America with the United States. It is estimated

that the New Silk Road can cover almost half of the total population of the world that is around 4.4 billion people. Three railways will be built on the land section of the new Silk Road. The northern corridor passes through Russia. The central and southern corridors are planned to pass through Central Asia. Later, highways will be added to the railway corridors. The main route of the New Silk Road passes through Central Asia. The length of the corridor is 6,500 kilometers, of which 4,000 kilometers are from the Pacific coast of China to the Xinjiang Uyghur Autonomous Region. From there, it travels through Kazakhstan, Uzbekistan, and Turkmenistan to Iran, Iraq, Syria and Turkey. And that oil is a step towards Europe. The sea route, like the old trade route, starts in Guangzhou and travels through Vietnam, Thailand, Malaysia, Singapore and Indonesia to the Red Sea and Africa. The new corridors aim to deliver cargo from China to Europe as soon as possible.

According to Zhao (2015) China's officials said that the regions along the "OBOR" had experienced strong economic growth rather than other regions worldwide, and the level of investment and trade dependence were higher than global degrees. It means that to promote the development of this kind of region we need to give priority to the investment and development of trade too.

There are many exemplary cooperation projects between Central Asia and China in the "One Belt One Road" (OBOR) Initiative. For example, the capacity cooperation between China and Uzbekistan includes 26 billion USD total investments. It includes more than 30 projects. It is a fact that in Central Asia infrastructure of China is especially important for the Central Asian countries.

China's President Xi said that Central Asian countries are the key

cooperation area and Central Asia is an especially important cooperation partner for the "OBOR" initiative in Tashkent when he visited Uzbekistan in 2016.

Both central Asia and China ought to reinforce the docking of advancement procedure and arranging, together look for beginning stages of collaboration, and persistently improve the degree of participation.

Chinese government had organized the Asian Infrastructure and Investment Bank (AIIB). Also, the Silk Road Fund was organized for further purposes.

There are fifty member countries with the countries which were outside of Asia too in AIIB. As well as other reasons for OBOR, the Asian infrastructure and Invest bank will be fully operational in the future, according to the World Bank (2015) its capital was one hundred billion US dollars (for the comparison, the total shareholders of the World Bank own more than 250 billion US dollars). The Silk Road Fund Co Ltd. is a 40 billion U.S. dollar fund dedicated exclusively to developing the transport and trade links in countries and regions along the Silk Road (Fung Business Intelligence Centre, 2015, p. 8). Other regional funds have also been set up (e.g., China-ASEAN Investment Cooperation Fund (for South-East Asia) and the China-CEE Investment Cooperation Fund (for Central and Eastern Europe)), which assist China's large international infrastructure construction policies (van der Putten & Meijnders, 2015, p. 31). The latter is endowed with 3 billion U.S. dollars and was announced in December 2014 with the aim to further enhance cooperation including plans of constructing "a new corridor of interconnectivity" (Rolland, 2015, p. 2). The Chinese OBOR program, in essence, provides a structure for Chinese diplomatic, commercial, and foreign infrastructure policies around the world to expand Chinese

exports and access to raw materials, and obtain new markets for Chinese trade and investment (van der Putten & Meijnders, 2015, p. 29).

As is distinguishable from that mentioned above, the Silk Road Economic Belt drive has eclipsed an absolute shipping lane—as the authentic one did likewise since it implied a hallway along which at any rate seven religions and a few persuasive Western masterminds showed up to China. Even though its idea stays as before as that of the chronicled Silk Road, its way to deliberately foster districts along the course are essential to exchange. China's advantage is to partake in the foundation of the worldwide climate, instead of being follower to the principles set up by different countries. Thus, the latest things of globalization will hold Western, however Chinese qualities too. Fostering its adjoining districts, and building the Silk Road Economic Belt, can impact to develop bilateral trade flows between Uzbekistan and China.

Chapter 3 Literature review

3.1 Literature review of bilateral trade

Obviously, bilateral trade is the trading of labor and products between two nations promoting trade and investment. The main goal of bilateral trade is to expand access between two countries' markets and increase their economic growth. Bilateral trade agreements can easily be negotiated rather than multilateral trade agreements. Also, parties can have trade benefits faster than multilateral trade.

In the global trading system, trading blocks are practically subjected to multilateralism and regionalism. Recently, the growth of the regional trading block has been one of the major developments in global economics. The structure of the regional trading block greatly varies in many ways, but they usually have the common objective of reducing trade berries amongst member countries by introducing tariff systems (Ghani et al. 2008). Through the free trade area in the regional trading block, bilateral trade flows are determined not only by income, population and distance, but also by the success of trade agreements that have been signed by regional member countries, such as ASEAN[5].

According to Gonzales, Bailes and Amano (1991) International Trade barriers can be divided into three parts i.e., Tariff Barriers, Institutional Barriers and Non-Tariff barriers. In addition to tariffs, non-tariff barriers (NTBs) are often used to control imports. According to Hillman (1991)

[5] Mohd Fairuz Md. Salleh, Wan Sallha Yusoff, Norida Basnan, Tengku Suriani Tengku Yaacob. "Knowledge Assets and Bilateral-Trade Flows in ASEAN-5 Countries: An Extension of Gravity Panel Data Model". Jurnal Ekonomi Malaysia 52(2) 2018 19 - 26 http://dx.doi.org/10.17576/JEM-2018-5202-2

NTB's all have limitations, except traditional customs duties which distort international trade. Typical non –tariff measures include quantity control measures such as licensing, quotas and prohibitions, as well as price control measures, health and safety measures (United Nations, 2008). Non-tariff barriers also constitute regulatory barriers, cultural barriers, and industry barriers. Some of the studies have categorized barriers into artificial and natural barriers. Artificial barriers are self-created barriers and natural barriers are not self-created (Balassa, 1965 & 1982; Basevi, 1966; Corden, 1966 & 1971).

Analyzing the bilateral trade flows of countries is widely used by researchers. Some researchers used the population as a main aspect while others believed that distance had a significant effect on bilateral trade flows. For example, Sohn, Chan-Hyun, who was Senior Fellow of Korea Institute for International Economic Policy researched Korea's Trade using Gravity Model. According to his paper, 'The Relapse After-Effects of the Examination,' it was discovered that Korea's reciprocal exchange designs fit the essential gravity model well and that between industry exchanges, as clarified by the Heckscher-Ohlin model, is common in Korea's global exchange. Along these lines, to grow respective exchange volumes, it has all the earmarks of being more attractive for Korea to advance reciprocal exchange with nations in nearness and having huge economies. Notwithstanding, Korea's real exchange volumes with nations like Japan and China which, as far as financial size and distance, present more noteworthy benefits, appear to miss the mark concerning the exchange volumes anticipated by the gravity model. This suggests that there are huge exchange hindrances among Korea and these nations. Subsequently, by advancing a more profound type of exchange progression with both Japan and China,

Korea is relied upon to completely misuse its exchange possibilities and augment the increases from exchange. Also, distance variable was used more as a statistically significant with the expected negative sign. It shows geographical distance is an important aspect for bilateral trade flows. As shown in table below, the coefficients of the log of the distances estimated by other previous studies.

Table 9 Comparison of distance coefficients

Year	*Researcher's name*	*Coefficient*
1966	Linneman	−0.76
1998	Frankel	−0.732
1999	Wall	−0.953
1999	Garman	−0.942
2001	Sohn,Chan-Hyun	−0.924
2018	Yan Peiheng	−0.62
2018	Mohd Fairuz Md. Salleh, Wan Sallha Yusoff, Norida Basnan, Tengku Suriani Tengku Yaacob	−0.564

Gross domestic product (GDP) is the total market value of all the finished goods and services produced in a country during a specific time period. GDP is typically calculated on an annual basis. The calculation of a country's GDP includes all private and public consumption, government outlays, investments, private inventories, construction pays and the foreign balance of trade. According to economic theories we give some explanations about GDP as below:

o Gross domestic product is the monetary and total market value of all goods and services made in a country in a specific time period.
o Gross domestic product provides an economic scale of a country, it is usually used to estimate an economy level and growth rate.
o Gross domestic product is usually calculated in several ways, using expenditures, production, and incomes.
o Gross domestic product is a key tool to guide policymakers, investors, and business in strategic decision-making.

Gross domestic product (GDP) is widely used as a main tool in analyzing bilateral trade especially with the gravity model method. In the gravity model, the economic scale of both parties is the main part. GDP or GNP can explain the economical scale of countries. According to the gravity model, high levels of GDP may increase bilateral trade flows.

The word population is a group of people or group of living beings. In statistics, a group of people are studying as a population. Population is also a main tool in the studying economy. Because demand for something directly belongs to the population size. The impact of population on trade flows may be different. Population may have a positive effect when the population size goes up it brings the higher level of specialists and technology. As a result, more products can be exported. However, some other researchers said that higher level of population may have a tendency to decrease income per capita, making everyone poorer. The low level of income per capita may cause a decrease in demand for export and import. For example, Karimi Hosneijeh (2008) researched negative population coefficients for both parties. It means that increasing the level of population decreases trade because more people need more of the products for domestic

uses. But this paper expects that a bigger size of population may have a positive effect on the bilateral trade flows. Because the more people there are the more demand for trade.

Logistics is one of the main aspects of trade. The fact has shown that better logistics performance is associated with international trade expansion, ability to attract foreign direct investments and economic development of the country. International trade of goods has been moved by a network of increasingly global logistic operators that deal with several functions in the international supply chains: ocean shipping, air freight, land transport, warehousing, and third-party logistics (Korinek & Sourdin, 2011; World Trade Organization, 2012). There were some empirical studies which had been analyzing the effect of logistic systems on trade flows. Levchenko (2004) and Francois and Manchin (2007) studied logistic competence. In this research they studied the quality of services delivered by the private sector. And they analyzed the impact of cargo storage services, transportation agencies, information technologies, packing services on the trade flows. Levchenko (2004) found the importance of differences across countries. Some other researchers used logistic performance index (LPI) as a main aspect of international trade.

Table 10. Previous studies of logistic aspects

Year	Author	Logistic features
2004	Mann and Otsuki	Infrastructure
2004	Levchenko	Logistics competence
2007	Persson	Predictability and reliability of supply chain
2008	Hoekman and Nicita	Domestic logistic cost

Logistic performance index (LPI) is a kind of index which is represented by the World Bank every other year since 2007. The purpose is to identify logistic opportunities of countries in international trade. According to the World Bank (2014) LPI helps to understand the challenges of logistic performance. LPI has six dimensions which are customs, infrastructure, international shipments, logistics quality and competence, tracking-tracing, and timelines (World Bank, 2007, 2010).

Customs index represents the quality of customs services. As we know the customs clearance procedures connected with export import agencies and other services at borders. According to the World Bank, the customs index is calculated due to the level of how customs declarations are processed electronically and clearly, how export and import occur according to the schedule, the information is complete and available on time, and submission of the documentation in customs clearance is expensive or not? All these

factors determine the customs index of LPI. Cipolla (2013) said that the impact of customs variables on international trade flows is especially important.

Infrastructure index is the quality of transport infrastructure and information-communication technology. High level of infrastructure may positively influence the communication among all parties of a supply chain. International shipment index represents managing deliveries and competitive cost of goods. Companies may benefit when they have a low transportation cost and good quality of services. Low transportation costs may positively influence international trade.

Logistic quality and competence index is particularly important in international trade. Customs brokers are responsible for the high level of logistic services. They work together to fulfill the customer requirements. According to the World Bank (2007) logistic quality will be higher when the private sector is well developed.

Timeliness is also an important aspect in a trading system. Timeliness is a main index of logistic performance. According to the delivery delays, lack of shipment, use of communication technology factors timeliness index determined in logistic performance.

Tracking and tracing index shows the quality of information and communication technology systems in logistics. Innovations in information and communication technologies are the main reason for the high performance of tracking and tracing indexes.

According to the World Bank, the global ranking of LPI started from Germany in 2018. Total LPI score of Germany was 4.20. Uzbekistan was at the 99^{th} level of LPI in 2018.

Table 11. Global LPI ranking (2018)

LPI Rank	Country	LPI Score
1	Germany	4.20
2	Sweden	4.05
3	Belgium	4.04
4	Austria	4.03
5	Japan	4.03
25	Korea Republic	3.61
26	China	3.92
71	Kazakhstan	2.81
75	Russian Federation	2.76
99	Uzbekistan	2.58
108	Kyrgyz Republic	2.55

(Source: World Bank)

Table 11 shows that the logistic system of Uzbekistan is in the middle average level in the world. If we contrast this with other Asian Countries, it takes more time to clear customs in Uzbekistan. The shipping cost in Uzbekistan is about 30-60% of the value of the cargo for exports. This index is also higher than other countries. These and other kinds of problems need to be solved. Because high logistic costs and low quality of logistic services may have bad effects for doing international trade with others.

3.2 Theoretical foundation of gravity model.

Worldwide exchange hypotheses are basically various speculations to clarify global exchange. Exchange is the idea of trading labor and products between two individuals or substances. Global exchange is then the idea of this trade between individuals or substances in two distinct nations. Individuals or elements exchange since they accept that they profit by the trade. They may

need or need the products or administrations. While at the surface, this may sound basic, there is a lot of hypothesis, strategy, and business methodology that establishes global exchange.

Adam Smith depicts exchange occurring because of nations enjoying outright benefit underway of specific products, comparative with one another. Inside Adam Smith's structure, supreme benefit alludes to the occurrence where one nation can create a unit of a decent with less work than another country. International trade was a key to the rise of the global economy. In the global economy, supply and demand therefore prices both impact and are impacted by global events. With the help of international trade, developed countries can use their resources. For example, labor, technology, or capital more efficiently. Different countries have different assets and natural resources: technology, labor, capital, etc. This allows some countries to produce the same goods more efficiently in other words, more quickly and with less of a cost. Accordingly, they may sell it more efficiently than different nations. If a nation cannot productively deliver a good, it can acquire it by exchanging with another country that can. This is known as specialization in international trade. Because of the global exchange hypothesis, regardless of whether a nation enjoys an outright upper hand over another, it can in any case profit by specialization. These sentences below can help to easily understand international trade theory:

- International trade is the trading of labor and products between nations.
- Trading internationally offers buyers and nations the chance to be presented to labor and products not accessible in their own nations, or which would be more costly locally.

- The significance of worldwide exchange was perceived from the beginning by political financial specialists like Adam Smith and David Ricardo.
- Still, some contend that global exchange really can be terrible for more modest countries, putting them in a difficult situation on the world stage.

The gravity model of global exchange worldwide financial aspects is a model that, in its customary structure, predicts reciprocal exchange streams dependent on the monetary sizes and distance between two units. Examination shows that there is "overpowering proof that exchange will in general fall with distance." The model was first presented in the financial aspect's world by Walter Isard in 1954. The basic model for the international trade between two nations explains as below model:

$$F_{ij} = G$$

In this model G is explained as a constant, F expresses trade flows, D is the distance and M describes economic measurement of the countries. The condition can be changed into a direct structure with the end goal of econometric investigations by utilizing logarithms. The model has been utilized by financial analysts to investigate the determinants of reciprocal exchange streams like basic lines, basic dialects, normal general sets of laws, basic monetary forms, regular pilgrim inheritances, and it has been utilized to test the viability of economic alliance and associations like the North American Free Trade Agreement (NAFTA) and the World Trade Organization (WTO) (Head and Mayer 2014).

The gravity model has been widely used in foreign trade research as a main model in recent years. The trade gravity model was described as "A

fact of life" by Deardorff (1998). As we know the gravity model in trade relates to Newton's Law of Universal gravitation. His recipe expresses that the gravitational fascination between two items is straightforwardly relative to their masses and contrarily corresponding to the square of their distance. Additionally, ample specialists blessed with the hypothetical legitimizations by assessing the model with assorted arrangements of factors and conditions[6]. For example, Tinbergen (1962) is famous for the use of gravity models. Because he was the first economist who proposed the gravity model to study international trade flows. He mentioned in his method: the trade between two countries connected with the economical degree of the countries and the geographical distance between them. Tinbergen's "gravity" formula is expressed as:

$$_{j} \quad G \frac{M_i^{\alpha} \; M_j^{\beta}}{D_{ij}^{\theta}}$$

F_{ij} is trade between one country and partner countries, it may explain total trade volume or export and import; M_i and M_j are the economical scale of the two countries, this is usually explained by GDP or GNP, D_{ij} shows the geographical distance between two countries.

At that point Linnemann (1966) introduced a fractional balance model of fare and import and added an extra factor to the model to mirror the exchange stream arrangement, a customary use of the gravity model.
Bergstrand (1989) demonstrated the trade gravity model like this:

6 Muhammad Saqib Irshad, Qi Xin, Zhang Hui & Hamza Arshad (2018) An empirical analysis of Pakistan's bilateral trade and trade potential with China: A gravity model approach, Cogen economics & Finance, 6:1, 1504409, DOI: 10.1080/23322039.2018.1504409

$$M_{ij}=a_0 Y_i^{a1} Y_j^{a2} D_{ij}^{a3} A_{ij}^{a4}$$

Mij is the total import of country i from country j during the certain time period; Yi is the GDP of the i country which is importing country; Y_j is the GDP of country j which is exporting country; D_{ij} is the distance between two countries; A_{ij} is the other factors which promotes or hinders the trade flow between both countries. Being a member of the same regional organization, common borders, speaking the same language, having the same religion can be examples for other factors. These factors may also affect bilateral trade flows.

Anderson (1979) who was the principal specialist to track down the hypothetical establishment for the exchange gravity model accepts that the simples' gravity model is really the rebuilding of Cobb-Douglas' use framework. His trade gravity model was as:

$$M_{ij}= Y_i Y_j / Y_w \ ,$$

Where Mij is the import of goods of country i from country j; Y_i is the total imports of goods from the world; Y_j is GDP of country j; Y_w is the GDP of the world. The use model did not consider the impedance variable like distance. Along these lines, Anderson's consumption model does not finish the hypothetical establishment work of the exchange gravity model [7].

[7] Yan Peiheng| (2018) A study on bilateral trade between China and the five Central Asian countries: A gravity model method, Pusan National University, Korea Republic

3.3 Specification and estimation of the gravity model

There are several advantages of the gravity model while analyzing bilateral trade. The estimates give the result in a static framework, furthermore, the reach out of intraregional exchange will potentially additionally increment if the assessment is completed in a unique structure, joining the impacts of components like terms of exchange, scale economies, innovation spill-over, speculation inflows, exchange progression. These could support the momentary exchange creation in this manner thinking little of the genuine since a long time ago runs impact. Some researchers explained that short - term impact is more than dynamic impact.

Matyas (1997) estimated that using three kinds of speciation, time, exporter and importer characteristics can show bilateral trade flows. While analyzing bilateral trade flows, total export volume or bilateral trade volume which is mainly expressed in currency was mostly used as a dependent variable in the gravity model method. The different kinds of variables which are GDP, income per capita, population, and distance between the two parties, tariffs, and transportation costs have been commonly used as independent variables in this model. The size of market and economic development level of a country can be estimated by other variables which are income level, land area, and GDP per capita. However, dummy variables, such as common culture, common language, common border, and common FTA are also used as positive factors in bilateral trade. Below table shows practical information about some researcher's empirical studies based on the gravity model:

Table 12. Previous studies on international trade modeling according to the gravity model

Year	Author	Objective	Dependent variables	Independent variables	Estimation method
2003	Mohammad Mafizur Rahman	Analysis of Bangladesh's Trade	Bilateral trade flows	GNP, GNP per capita, Tax, distance, Trade – GDP ratio, common border, common member of SAARS	OLS
2005	Chan-Hyun Sohn	Analyzing th Korea's bilateral trade	Bilateral trade flows	Product of GDPs, product of GDPs per capita, distance,	OLS
2007	Swapan K. Bhattacharya and Biswa N. Bhattacharyay	Analysis of bilateral trade between India-China	Bilateral trade flows	GNP, GNP per capita, distance, tariff rate,	-
2018	Piratdin Allayorov, Bahtiyar Mehmed, Sazzadul Arefin, Norbek Nurmatov	Analysis of Kyrgyzstan's Bilateral trade	Bilateral trade flows	GDP, population, distance	-
2018	Muhammad Saqib Irshad, Qi Xin, Zhang Hui & Hamza Arshad	Analysis of Pakistan's trade potential with China	Total trade of Pakistan with FTA partners	Products od GDPs, Trade cost, Inflation, openness of Pakistan, Openness of partners, religion, language, common border, WTO, membership, trade agreements	REM

3.4 Previous studies on bilateral trade using a gravity model method

In recent years, researching on international trade flows of Central Asian countries has been more popular. With the stability of the political situation and advancement, economic development in Central Asia has yielded huge achievements. From 1997 to 2016, the GDP of the central Asian countries increased from 43 billion US dollars to 254, 2 billion US dollars, annually increasing by 9, 9% on average.[8]

Central Asian countries are situated in the heart of the Eurasian continent, with a total area of more than 4 million square kilometers. The ancient Silk Road has also been the main reason for trade relations between China and the five countries in Central Asia – Uzbekistan, Kazakhstan, Turkmenistan, Tajikistan and Kyrgyzstan. Reconstructing the "New Silk Road Belt" by China has a great effect on increasing the trade relations for China with Central Asian countries, especially with Uzbekistan.

As to affecting components and capability of bilateral trade among China and Central Asia, Wei and Xu (2017) accept that the effect of China's financial advancement on respective exchange is more noteworthy than Central Asia. Advancing China's financial improvement can more adequately increment reciprocal exchange volume; geographical distance and taxes are obstructions to respective bilateral trade flows, yet their negative impact is debilitating with the advancement of innovation; the higher the level of transparency of them, the more prominent the bilateral trade flows; however, the low degree of similarity in the modern design of China and Central Asia isn't conductive to bilateral trade volume.

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[8] Yan Peiheng (2018) A study on the Bilateral Trade between China and the Five Central Asian Countries: A Gravity Model Method, Pusan National University, Korea Republic

Huang (2015) contemplated the exchange capability of China (Xinjiang) and five Central Asian nations on major farming items through embracing the factors of GDP, GDP per capita, population total, distance, and value added of agricultural output. Additionally, Gao (2015) firstly used tariff variables to measure the trade potential of Central Asia and China. Zhang (2016) explained the reciprocal exchange capability of Central Asia and China by the Foreign Direct Investment variable and the trade dependence variable. Above researchers had utilized a gravity model to analyze the affecting components and trade potentials between Central Asian nations and China. We can easily understand that several researchers used different methods and different explanatory variables in their research. Although some used the same variables in their gravity model, regression results were different. Table below shows the previous studies and the variables. These studies provide important references to set the gravity model method in this paper.

In 2010, some researchers analyzed the trade creation and trade diversion effects of the regional trade agreements in Asia using the gravity model method. The name of the paper was "Trade Blocs and the Gravity Model: A Study of Economic Integration among Asian developing countries". According to this paper's result estimation, the influence of language and culture on the trade was important.

Table13. The previous studies of trade relation between China and Uzbekistan using a gravity model

Year	Author	Objective	Dependent variable	Independent variables	Estimation method
2010		Analyzing the trade creation and trade diversion effects of the regional trade agreements in Asia	Trade flows	GDP, population, distance, border, language, colony	OLS
2015	Gao and Liu	Estimation and Prospect of Trade Potential between China and Central Asia	Export and Bilateral trade flow	GDP, population, distance, tariff rate, SCO dummy, WTO dummy, common border dummy	OLS
2017	Wei and Xu	Analysis of the influencing factors of trade between China and Central Asia	Bilateral trade flow	Multiplied GDP, distance, openness, population, industrial structure similarity, exchange rate, tariffs, common border dummy, SCO dummy, "OBOR"	OLS

Chapter 4. Methodology and Results

4.1 Model specification and data explanation

According to the other trade gravity model used by Tinbergen (1962) and Yamarik and Ghosh (2004), to measure the international trade flows. In its original form, the gravity model is specified as follows:

$$Tij = A\frac{(GDPiGDPj)^{b1}}{(Dij)^{b2}}$$

Equation (1)

Where:

Tij is the variable of bilateral trade between country i and country j.

GDPi is a country 's national income.

GDPj is a country 's national income.

Dij is the geographical distance between the countries.

A is a constant of proportionality.

Using the logarithm, we obtain this:

Log (Tij)=log(A) $+b_1$log (GDPi*GDPj)$-b_2$log (Dij);

Equation (2)

Then adding stochastic component, we obtain this equation:

$\text{Log } (Tij)=\log(A) + b_1 \log (GDPi * GDPj) - b_2 \log (Dij) + uij;$

Equation (3)

Within this we can test the impact of other variables on the bilateral trade flows. Taking the logarithms of gravity model Equation (3) and based on other scholar's related research, combined with the purpose of this paper's study, this equation is used as a gravity model in this paper (Equation 4). The logarithmic form will be used for estimation and interpretation in this paper.

$$\text{Log } (T_{ij}) = \beta_0 + \beta_1 \text{ Log } (Y_i) + \beta_2 \text{ Log}(Y_j) + \beta_3 \text{ Log}(POP_i) + \beta_4 \text{ Log}(POP_j) + \beta_5 \text{ Log}(LPI_j) + \beta_6 \text{Log}(LPI_j) + u_{ij}$$

Equation (4)

Where:

β_0 is a constant term.

From $\beta 1$ to β_8 are regression coefficients.

u_{ij} is the error term.

T_{ij} is bilateral trade flows between Uzbekistan and partner countries.

Y_i refers to the gross domestic product (GDP) of Uzbekistan.

Y_j refers to the gross domestic product (GDP) of a partner country.

POP_i indicates the population of Uzbekistan.

POP_j indicates the population of partner countries.

LPI_i is the logistic performance Index of Uzbekistan.

LPI_j is the logistic performance Index of partners.

D is the distance between Uzbekistan and partners.

T_{ij} is the dependent variable; while Y_i, Y_j, POP_i POPj, LPI_i, LPI_j and D are independent.

As in most past studies, a large average of GDP and knowledge assets (proxy for an average economic size) is expected to increase the two-way bilateral trade due to a great demand for products and economies of scale (Thanh & Ji 2014). Hence, the sign of Yi and Yj's coefficient is expected to be positive. According to other previous papers, it is a fact that the population of the country has a positive effect on bilateral trade. This paper also expected positive signs from the population variable (POPi).

International trade consists of logistic operations in transporting and storing the products. High logistic cost and low quality of logistic services may have a negative influence on the trade flows. Logistic performance index includes six dimensions which are customs, infrastructure, international shipment, logistic quality and competence, tracking and tracing and timelines. According to these, the contribution of LPI is to analyze logistical aspects of bilateral

trade while Uzbekistan has not a good quality of logistic system. Because better logistic performance has an opportunity to attract foreign direct investment and international trade ability. So, this paper expects positive influence of logistic performance index variables.

Below table expresses that expected influence and definition of all variables.

Table 14. Variables of gravity model and related explanations

Variable	Interpretation	Expected sign	Value	Theoretical analysis	Data source
T_{ij}	Bilateral trade flow between Uzbekistan and China		Current US dollar	The increase of total trade volume indicates a bright	UN Comrade
Y_i	GDP of Uzbekistan	+	Current Us dollar	The more economic development the more demand for the trade	World Bank
Y_j	GDP of China	+	Current US dollar	The more economic development the more demand for the trade	World Bank
POP_i	Population of Uzbekistan	+	Total (Million people)	More population gives more opportunity to trade	World Bank
LPI_i	Logistic performance of Uzbekistan	+	Ranked From 1 to 5	Better quality of Logistics system gives a big opportunity to international trade	World Bank
LPI_j	Logistic performance of Partner countries	+	Ranked From 1 to 5	Better quality of Logistics system gives a big opportunity to international trade	World Bank
D	Distance from capital of Uzbekistan to capital of partner country	−	Km	Short distance is low transportation cost	Google Map

The dataset type of this paper is "Panel" kind. And the time series includes 29 years from 1991 to 2019. Uzbekistan is the reporting country while China, Kazakhstan, Kyrgyzstan and Russia are used as a partner. This dataset includes 7 variables and 116 observation ranges. Uzbekistan got its independence in 1991. Because of that this paper cannot collect data before 1991. Regression is calculated using software STATA /IC 14.2 for multiple linear regressions.

4.2 Results

Table15 reports the descriptive analysis of the bilateral trade flows of Uzbekistan and China countries and its explanatory variables. Table 16 shows empirical results of the gravity model.

Table 15. Descriptive statistics of all used variables

Variable name	Observations	Mean	Standard deviation	Min	Max
Yi	29	16	8.803408	2	30
Yj	29	16	8.803408	2	30
POPi	29	16	8.803408	2	30
LPI_i	29	14.03448	8.457806	1	28
LPI_j	29	16	8.514693	1	30
D	29	9.724138	7.530398	1	23
Tij	29	14.03448	8.457806	1	28

This study continues with estimating a panel data regression model to analyze wealth factors, which may contribute to the growth of bilateral trade flows of Uzbekistan and partners. Before running the regression, all the variables were taken to logs. And standardization has been done for all

variables except dependent variables.

Table 16 explains the regression, which is based on the Pooled OLS model, using the least- squares method for multiple linear regression.

Table 16. The empirical results of Pooled OLS model

Variable	Coefficient	T -value	P -value
Yit	-3.088998	-1.84	0.085
Yjt	2.688335	4.67	0.000
POPit	3.482173	1.94	0.071
POPjt	-1.300548	-7.83	0.000
Dij	-0.4244493	-0.86	0.405
LPIit	0.935495	2.18	0.045
LPIjt	-0.869822	-0.76	0.457
C	20.46769	181.36	0.000
R^2	0.8817		
Adjusted R^2	0.8737		

According to the Pooled OLS model results, GDP of partners, population of partners and LPI of Uzbekistan variables are statistically significant.

Unfortunately, the population of partners has a negative sign opposite than expected. R square is 0.8817 while adjusted R squared is 0.8737. OLS regression results show that if the GDP of partners increases by one million US dollars, bilateral trade between Uzbekistan and partners increases to 2.6 million US dollars. But if the population of partners increases to one million people, it will decrease bilateral trade to 1.3 million US dollars. When LPI of Uzbekistan increases one level score, it will increase bilateral trade by 0.9 million US dollars.

However, there is an issue of OLS results. The dataset in this study is panel data. An OLS model regression is likely to be ineffective with panel dataset. To solve this problem, we conduct fixed effects model (FEM) and random effects model (REM) analysis. To determine the best statistical and reliable estimation of the model, this paper compared these models. The Hausman test was conducted to check the correlation between unobservable heterogeneity and explanatory variables. The probability result was more than 0.05, so the null hypothesis is not rejected. This means that the random effect model is fit-able. According to the Hausman test result we continued with a random effect model. Table 17 shows the result of the fixed effect model and random effect model.

Table 17. The empirical results of fixed and random effects Models

Variable	Fixed effects model	Random effects model
Yit	−3.01**	−3.08*
Yjt	5.59***	2.68***
POPit	3.05*	3.48*
POPjt	−3.32	−1.3***
Dij	−	−0.4
LPIit	0.07**	0.09**
LPIjt	0.5	−0.08
C	20.37***	20.46***
R^2	0.874	0.794
Adjusted R^2	0.784	0.734

(Note: *** means p<1%, ** means p<5%, *** means p<10%)

Table17 presents that the overall performance of the gravity models for knowledge assets and international trade flows are satisfactory in terms of statistical significance. The constant terms, Yj, POPj, and LPIi are all statistically significant at the level 1% to 5% level. Yi, POPi LPIj and Dij are not significant. R-squared for the equation is 0.78, which shows the total performance of the model is strongly expressed. The coefficient of determination (R^2) for this model suggests that 78% of dependent variables are explained by independent variables. This model's significance reveals that bilateral trade between Uzbekistan and partner countries is well explained by the gravity model.

Unfortunately, the result of the regression shows that the GDP of Uzbekistan, which is β_1, a negative sign, is different from as expected. The estimated coefficient of Uzbekistan's GDP is -3.8. Regression result shows the GDP of partners (Yj) is 2.68, which suggests that, if GDP of partners goes up by one million US dollar, bilateral trade flow between Uzbekistan and its trade partners will increase by 2.68 million US dollar. There is a difference between Uzbekistan's economy scale and partners', so the effect of the economic scale on the trade is also different. Although the economy of both parties is still growing in recent years, the growth rate of Uzbekistan has slowed down. Foreign trade is not a huge part of the total GDP of Uzbekistan. This fact may be the reason that GDP of Uzbekistan (Yi) has a negative impact on the trade demand between Uzbekistan and partners.

Against the expectation, the population of partners, β_4, is statistically significant, with a negative sign. If the estimated coefficient of partners' total population increases one million, bilateral trade volume will decrease by 1.3 million US dollars. According to theoretical expectation, a great number of populations have the opportunity to trade in a large variety of goods.

Population size of Uzbekistan's partners is different from each other. As we know the population of China is excessively big while Russia does not have a huge population. Population of Kazakhstan is at the average level, but the population of Kyrgyzstan is lower than other partners.

The regression coefficients show that the impact of Uzbekistan's logistic performance index on bilateral trade flows is positive, which is the same as expectation. One level increase of LPI increases the bilateral flows trade 0.9 million USD. International trade consists of logistic operations in transporting and storing the products. High logistic cost and low quality of logistic services may have a negative influence on the trade flows. Logistic performance index includes six dimensions which are customs, infrastructure, international shipment, logistic quality and competence, tracking and tracing and timelines. Better logistic performance has an opportunity to attract foreign direct investment and international trade ability. Developing the logistic system gives more opportunity to do international trade with partners.

Chapter 5. Conclusion

After the independence of Uzbekistan trade relations with China, Russia, Kazakhstan and Kyrgyzstan have become increasingly close. For China, Uzbekistan is both an important export market and energy supply base while Russia and Kazakhstan are main agricultural products resources for Uzbekistan. For Uzbekistan, China has advanced technologies markets which are helpful to develop Uzbekistan's economy. Over the past twenty years, the trade volume between Uzbekistan, China, Russia, Kazakhstan and Kyrgyzstan has gradually expanded. According to this background, this paper aimed to use the gravity model for analyzing and hindering effects of bilateral trade between Uzbekistan and its trade partners. And this paper provides some suggestions for both countries to plan their international trade in the future.

Due to the regression results of the gravity model, we can find that the GDP of partners of Uzbekistan, population of Uzbekistan, level of logistic performance index of Uzbekistan has a significant role in promoting bilateral trade volume. After 1995, both parties Uzbekistan and its neighbors entered a period of rapid development. The level of GDP directly determines supply and demand of both parties. The economic developed countries influence more than smaller countries. This idea had been in the studies of Gao and Zhang (2010). It is obviously explained by previous studies that population can positively impact bilateral trade. But this paper concluded that the population of partner countries has a negative effect on the bilateral trade flows between Uzbekistan and them.

The logistic performance index has positive effects on bilateral trade volume. According to this paper's result, the degree of LPI of Uzbekistan has

a positive influence on the bilateral trade flows between Uzbekistan and chosen partners. International trade consists of logistic operations in transporting and storing the products. It has already concluded that high logistic cost and low quality of logistic services may have a negative influence on the trade flows. Logistic performance index includes six dimensions which are customs, infrastructure, international shipment, logistic quality and competence, tracking and tracing and timelines. All the dimensions can be changing the level of international trade. Better logistic performance has an opportunity to attract foreign direct investment and international trade ability. Uzbekistan, where energy and mineral resources are abundant, should develop the level of international trade to exchange these natural resources to foreign investment with neighbors. Short distance and low transportation cost give more opportunity for international trade. This advantage is the main reason for developing beneficial bilateral trade with China, Kazakhstan, Kyrgyzstan and Russia. Uzbekistan is a landlocked country which must pass at least two countries to reach sea transport. So chosen countries as a partner would be the bridge to reach the seaways using the railroads.

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Appendix

〈Appendix 1〉 Country information

Country	Capital	Distance with Tashkent	Bordering with Uzbekistan	WTO membership
Uzbekistan	Tashkent			No
China	Beijing	3933km	No	Yes (2001)
Kazakhstan	Astana	1611.6 km	Yes	Yes (2015)
Kyrgyzstan	Bishkek	633.6km	Yes	Yes (1998)
Russia	Moscow	3377.1km	No	Yes (2012)

〈Appendix 2〉 Source of data for variables

Tijt: UN Comtrade (https://comtrade.un.org/data/)

Yi/Yj: World Bank (https://data.worldbank.org/)

Pop i/ Popj: World Bank (https://data.worldbank.org/)

LPIi/LPIj: World Bank (https://data.worldbank.org/)

Dij: Google Map

국 문 초 록

우즈베키스탄과 무역 파트너간의 양자 무역 분석: 중력 모델 방법

아 브 로 르 존
국 제 무 역 경 제 전 공
국 제 무 역 경 제 학 과
한 성 대 학 교 대 학 원

이 논문은 우즈베키스탄과 주요 무역 상대국 및 주변 국가 간의 양자 무역을 분석하는 것을 목표로 한다. 이를 위해 1991 년부터 2019 년까지 29 년 동안 우즈베키스탄과 파트너 국가간의 양자무역 활동에 대해 중력모형을 이용하여 분석을 수행하였다. 회귀 결과는 중력 모델의 기본 가정을 확인하고 우즈베키스탄 무역 파트너의 GDP가 양자 무역량에 긍정적 인 영향을 미친다는 것을 나타냈다. 파트너 국가의 인구수 역시 양자 무역에 긍정적인 영향을 미치는 것으로 나타났다. 그리고 물류 성과 지수의 정도(Logistic Performance Index: LPI)는 양자 무역 흐름의 발전을 촉진하는데 주요한 역할을 하는 것으로 나타났다. 특히 우즈베키스탄의 LPI는 양자 간 무역 흐름에 긍정적 인 영향을 미쳤다. 우지베키스탄과 파트너 국가간의 무역 발전은 물류 시스템의 열악함, 운송 구조 및 지불 불균형과 같은 많은 문제에 직면해 있다. 이 논문의 결과는 우즈베키스탄 무역 정책과 향후 계획을 제시한다. 높은 물류 비용과 낮은 품질의 물류 서비스는 무역 흐름에 부정적인 영향을 미칠 수 있다. 더 나은 물류 시스템은 외국인 직접 투자 및 국제 무역 능력을 증진시키는기회를 제공할 것이다.

【키워드】 양자무역, 물류성과지수, 중력모형, 우즈베키스탄.

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