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TRADE PATTERNS OF AZERBAIJAN: GRAVITY MODEL APPROACH[2]

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ABSTRACT

This study investigates the trade patterns of Azerbaijan by using the Gravity model approach. Bilateral trade, import, export, and non-oil export has been analyzed as dependent variables. We used WITS and CEPII datasets to run panel regression to explore the impact of economic size (GDP per capita, population, land area) and geographical position (distance) on bilateral trade. The results indicate that GDP per capita of origin and destination countries is positively correlated with bilateral trade and import while distance factor is found to be insignificant. However, we explain the insignificance of distance by the large share of products which is insensitive to geography and distance factors (share of oil products in total export is more than 90% which rely on long-term contracts). However, we found that distance has a negative impact on non-oil export. Thus a 1% rise of GDP per capita for destination and origin country leads to an increase in Non-Oil export by 0.67% and 0.51%, respectively.

Keywords: International trade; gravity model; export; import; Azerbaijan.

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INTRODUCTION

Azerbaijan is a small, open economy located in the South Caucasian region that extensively tries to integrate into the world economy. Immediately after the collapse of the Soviet Union, Azerbaijan could not completely open its borders to the world economy without any regulations as the liberalization of foreign trade might hurt domestic production and increase its dependence on foreign markets. Concrete steps towards the improvement of domestic production did not comply with International Monetary Fund's and World Bank's regulations, therefore faced significant protests from these organizations. However, there was still a small trade deficit in the trade balance of Azerbaijan until 1999. As a result of transportation oil and oil products to the world market since, 2000 the total trade volume of Azerbaijan jumped substantially, around 50 % in 2000 compared to 1993. Even though Azerbaijan is a member of the Commonwealth of Independent Countries (CIS), which was founded in 1991 to maintain sustainable economic and political relations amongst former Soviet countries, Azerbaijan has been preferred to trade with Western Countries rather than CIS countries. Such that weight of import from CIS countries was 80% in 1991, and it has been decreased tremendously since 2000, standing at only 20 % in 2015. In terms of export, only 9.3 % of total export has been conducted with CIS countries (Osman et al., 2016). Therefore, rather than focusing on regional and Post-Soviet Countries, we attempt to broaden our research by selecting countries around the world.

The goal of the present paper is to find drivers of Azerbaijan's export, import, and total trade with 11 predetermined countries. This study is unique and fills the gap in the literature of Azerbaijan's trade structure for some reasons. First of all, interestingly, when we conduct a literature review, we could not find sufficient papers dedicated to the Azerbaijan trade structure. Secondly, separating the oil sector from total trade and applying the gravity model was also quite rare in the literature. The outcomes of the study show that GDP per capita for the origin and destination countries and land factors are positively correlated with non-oil export while distance affects negatively non-oil export. By contrast, the distance appears an insignificant factor in total bilateral trade.

The paper is organized as follows: In the next part, we will give a descriptive analysis of Azerbaijan's trade structure during 2000-2019 and formulates the research question. In the second part, we compare the main findings with the results of other studies and discuss how our paper can fill the gap in the exciting literature. Then detailed descriptions of the data and the methodology for analyzing the paper have been presented with the specification of the gravity model. Next, we reported and interpreted empirical results by listing several concluding remarks. Finally, in the last part, we end the paper by describing a summary of the research outcomes and some policy implications.

1. AZERBAIJAN'S FOREIGN TRADE OVERVIEW

After regaining independence from the Union of Soviet Socialist Republic in 1991, Azerbaijan faced serious economic recession, as Azerbaijan's economy is forced to implement the economic transmission process from Centrally Planned Economy towards Market Economy. The third president of the Republic of Azerbaijan, Heydar Aliyev signed "The Contract of the Century" on September 20, 1994, which this contract was the turning point of Azerbaijan's Economy. Signing this contract has resulted in the transportation of crude oil to the world market through Baku Tbilisi Ceyhan (BTC) pipeline. Map1 shows the BTC pipeline starting from Baku, Azeri-Gunesh-

Chiraqli oil field and goes through Georgia ended in Ceyhan Port in Turkey. The construction of the BTC pipeline changed the geographical importance of Azerbaijan in the region significantly. Since Baku-Tbilisi-Ceyhan transport, not only Azerbaijan crude oil but also Kazakhstan and Turkmenistan used this pipeline to supply their crude oil to Europe. Only in 2015, 5.2 million Turkmen and Kazakh oil was reached to the world market.

From the map, we clearly see that Armenia and Iran stayed away from this project while Georgia played a vital role to make this project reality. Russia saw this project as the main danger to its "South stream" and immediately condemned it by stating that it is commercially not viable. Armenia Diaspora around the world spends millions on preventing the construction of BTC. However, the persistence of Azerbaijan and the help of the US government played a crucial role to defeat geopolitical pressure from Russia and Iran as well as some human rights organizations (Ismayilzade, 2005)

Map 1: Oil and gas pipelines of Azerbaijan

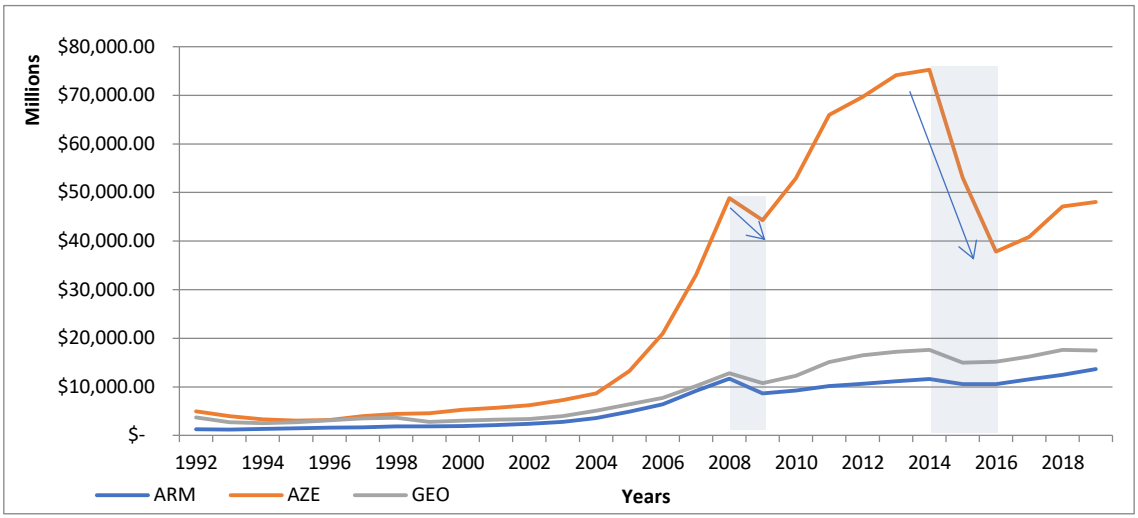
Source: *Caspianbarrel.org*

Azerbaijan's economy accomplished huge economic improvement since the start of the 21st century. As we referenced above, this economic development predominantly depends on the oil area of the economy. Azerbaijan is a common illustration of an oil-based economy since, with respect to average, oil and oil products comprised more than 80% of Azerbaijan's export for the most recent decade (Figure 4 and 5). In spite of the fact that Azerbaijan attempts to reduce its reliance on oil and oil incomes through the advancement of a non-oil area and broadening of the economy, so far it made some progress, yet, oil incomes contain a huge piece of real GDP. Subsequent to the beginning, the transportation of raw petroleum to the world market and a considerable increment in the cost of oil prompted the inflow of income to Azerbaijan. Obviously, the fast expansion in oil incomes influences economic development in Azerbaijan. For example, in 2006, Azerbaijan was a pioneer country in the world as the GDP growth rate was 34. 5%, and furthermore, the money supply rose multiple times before the financial crisis in 2008 (Hasanov, 2010). Figure 1 compares Azerbaijan GDP growth with the region's other countries, Georgia and Armenia. As we can observe after 2005, a huge gap in GDP suddenly appears, and over the year, this gap expands with some fluctuations.

Apart from oil and gas, Azerbaijan exports chemicals, iron and steel, foods including fruits and some vegetables, beverages. Italy, Turkey, Israel, India, and Germany are the main export

destinations of Azerbaijan. As of 2019, Azerbaijan exported goods and services with a total value of 19.7 billion. Russia, Turkey, China, Switzerland, and United States are the main suppliers of goods and services to Azerbaijan (World Bank, 2018). Pie charts demonstrate the share of main customers and main suppliers in total export and import volume respectively in figure 2 and 3.

Figure 1: Comparisons of GDP in current prices for Azerbaijan, Georgia, and Armenia



*Shaded areas emphasize 2008 financial crisis and decrease in oil prices in 2014 respectively

Source: *Authors' own calculations based on data from Worldbank.org*

At the more granular four-digit Harmonized Tariff System code level, crude oil represents Azerbaijan's most valuable exported product at 75.4% of the country's total global sales. In second place were petroleum gases (12.1%) followed by processed petroleum oils (2.4%), fresh or chilled tomatoes (1%), unwrought gold (0.9%), miscellaneous fresh fruits (0.7%), miscellaneous nuts (0.6%) then uncarded cotton (also 0.6%).

As we already discussed that Azerbaijan's export industry heavily relies on crude oil and oil products. Oil and gas account for more than 90% of Azerbaijan's exports since 2005. Figure 4 presents oil export share in total export to 11 selected countries for the gravity model.

Table 1: The main products in Azerbaijan's exports and imports

Share of exported products	
Petroleum oils and oils obtained from bituminous minerals, crude	75.4%
Petroleum gas and other gaseous hydrocarbons	12.1%
Petroleum oils and oils obtained from bituminous minerals(Excl. Crude)	2.4%
Tomatoes, fresh or chilled	1.0%
Gold, including gold plated with platinum, unwrought	0.9%
Rest of products	8.2%
Share of imported products	
Gold, including gold plated with platinum, unwrought	15.5%
Motor Cars and other motor vehicles	4%
Petroleum oils and oils obtained from bituminous minerals(Excl. Crude)	2.9%
Wheat and meslin	2.5%
Medicaments consist of mixed or unmixed products	1.9%
Rest of Products	73.2%

Source: *World Bank (2018)*

Figure2: Main export partners of Azerbaijan

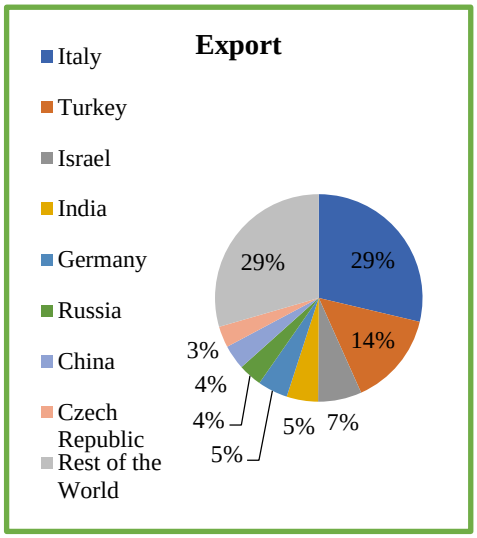
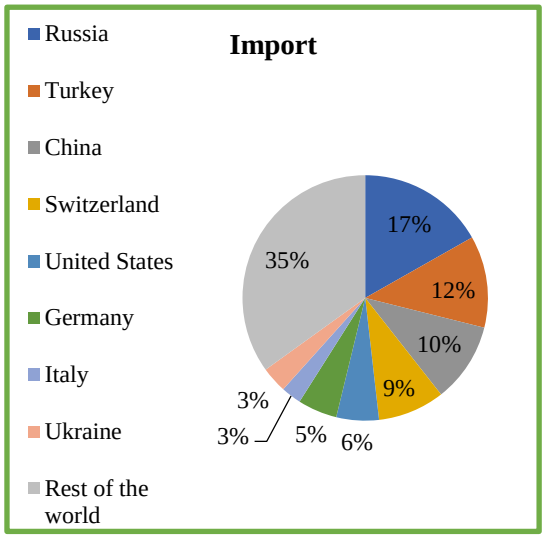
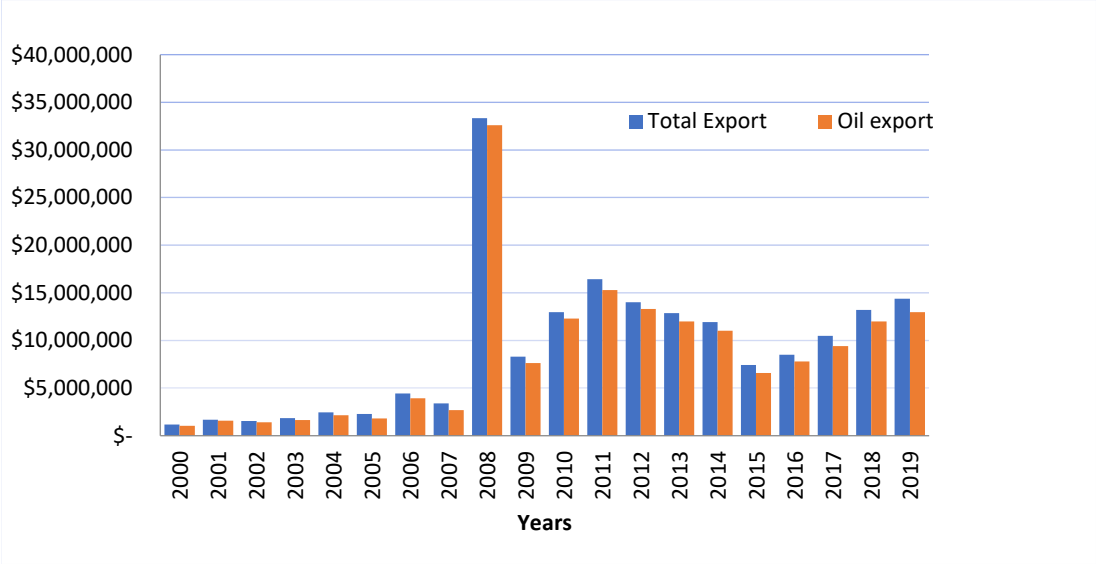


Figure 3: Main import partners of Azerbaijan



Source: *World Bank (2018)*

Figure 4: Share of oil and oil-products in total export

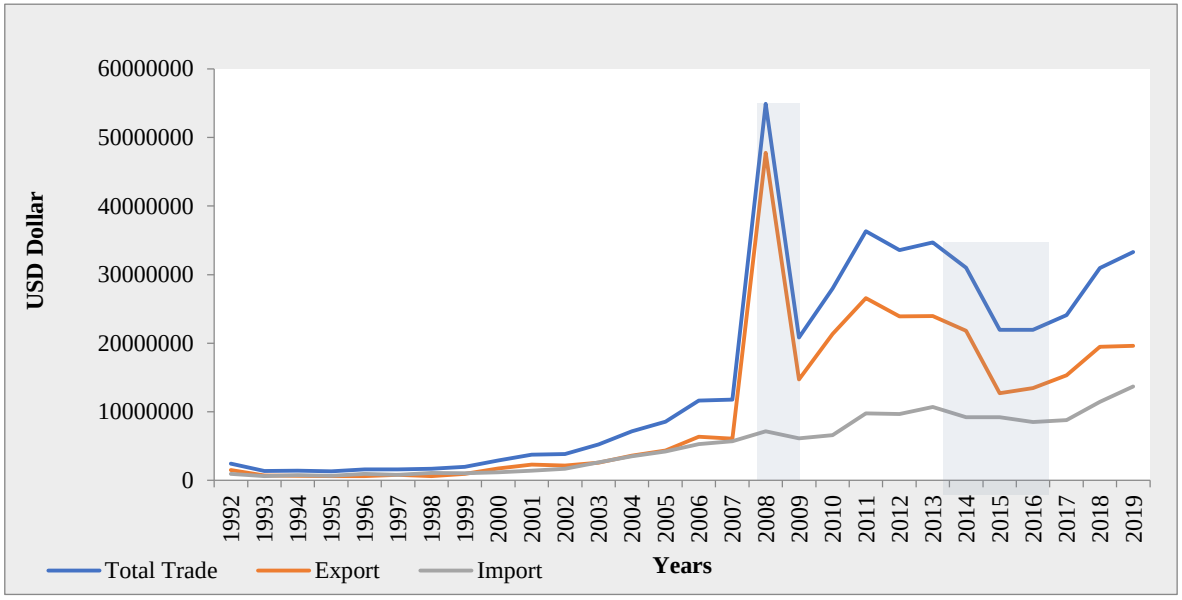


Source: *Authors' own calculation (Data from The State Statistical Committee of Azerbaijan and World Bank)*

Finally, according to UN Comtrade, as of 2018, Azerbaijan exported services with a value of 4.59 billion dollars while it imported $6.7 billion worth of services. Top services exported by Azerbaijan included Personal travel ($2.4 B), Transportation ($1.22 B), and Business Travel ($597 M), as well as Computer and Information services and other services worth $79 million and $528 million, respectively. The top services which Azerbaijan imported during 2018 were Personal travel ($1.98 B), Transportation ($1.52 B), Business Travel ($299M), Construction Services ($1.33B), and other services ($1.66B). (UN Comtrade, 2018)

As mentioned earlier, after the first oil transportation via the Baku-Tbilisi-Ceyhan pipeline, Azerbaijan economy witnessed a huge increase both in export and import trade. Subsequently, increasing oil revenues financed government expenditure and import trade, which resulted in a sudden increase in the volume of imported products as well (Musayev and Aliyev 2017).

Figure 5: Azerbaijan's Import, export and total trade over the years



Source: *Authors' own calculations*

However, the 2008 financial crisis in response to Mortgage Failure in the US hit all economies in the world, including Azerbaijan but to a lesser extent than other countries (Mikayilov, 2009). Such that along with the financial crisis, oil prices fell significantly in the world market and led to serious decreases in oil revenue and ultimately total trade. The second downside trend in Figure 4 started after 2014 as world oil prices went down 3- folds time which resulted in ending the "honeymoon" period of the Azerbaijan economy (Musayev and Aliyev, 2017). After the 2008 global financial crisis, Azerbaijan's trade volume experienced a second-time considerable decrease as a result of decreasing oil revenues and lower capital transactions from the State Oil Fund of the Republic of Azerbaijan (SOFAZ) to budget.

2. LITERATURE REVIEW

There is a large body of empirical studies that attempts to determine the determinants of bilateral trade over the country by using the standard Gravity model. Early studies mainly focused on the relations between distance and economic size of countries and trade volume. Primarily expectation is that the countries that are geographically close to each other or share borders will trade with each other more than remote countries. Since we attempt to find determinants of Azerbaijan's trade economy, it would be reasonable to start with similar studies dedicated to South Caucasian countries. Papachashvili et al. (2018) investigated the drivers and impediments of Georgia's exports to 33 Free Trade and Preferential partner countries from 2000 to 2015. The main findings of the paper show that partner size (GDP and Population) are positively and significantly influence Georgia exports, while distance is a negative factor that reduces the export volume of Georgia to Free Trade and Preferential partner countries (Papachashvili et al., 2018). Once both Georgia and Azerbaijan are small economy and located in the same region with many similarities in terms of land size and colonial past, we expect somehow similar conclusions.

One popular study by Hovakimyan (2016) is devoted to finding country-specific determinants of Armenia's export, import, and total trade by using data from 2011 to 2015. As the global financial crisis hit almost all economies around the world, it took Armenia nearly 3-4 years to recover and

to reach the pre-crisis level. The author used the augmented Gravity model and revealed that quite surprisingly, landlocked and border variables are not significant while as expected GDP and distance are positive and negative factors, respectively (Hovakimyan, 2016).

Empirical literature analyzing Azerbaijan's export, import, and total trades is still rather limited. In one interesting paper, Zeynalov (2016) approached the problem from somehow different perspectives both in terms of model and variables, such that he attempted to explore the effects of similarities in economic size and institutional level on bilateral trade by using Poisson Pseudo Maximum Likelihood (PPML) rather traditional Gravity Model. The study indicates that similarity of income size is a crucial factor for increasing bilateral trade across countries as well as trade volume is considerably higher with countries which high quality of low and less corruption exist. Another very promising finding of the paper is that distance is not a significant factor for Azerbaijan trade volume. It can be explained by the fact that natural resources comprise more than 90% of Azerbaijan export trade, and trade volume heavily rely on long-term contracts, which reduces the significance of distance in the long term (Zeynalov, 2016). Martinez-Zarzoso (2003) applied the gravity model to determine which commodities are more sensitive to geographical and distances factors. The outcomes of the study demonstrate that, for instance, commodities such as furniture and footwear enjoy geographical effects. Therefore, we conclude that the determinants of trade volume can vary across the countries if countries export completely different kinds of products.

In one notable paper, Willem (2015) investigates Japan's exports to the United States and other 30 countries over 27 years by applying the Gravity model. The model by Thorbecke (2015) includes distance, GDP, and dummy variables such as FTA (If there are free exchange agreements between countries) and being a member of ASEAN. The empirical outcomes of this study show that after the financial crisis of 2007, Japan exports to the USA decreased relatively. In the meantime, exports from Japan to Thailand increased. Furthermore, results revealed that Japan's exports to ASEAN countries have increased over the two decades relative to the USA. This finding proved that indeed free trade agreements and distance play a significant role in Japan's export performance (Thorbecke, 2015).

Rahman (2009) endeavours to explore trade potential for Australia utilizing the expanded gravity models and cross-segment data over the 50 countries. His outcomes uncover that Australia's bilateral trade is influenced emphatically by economic size, GDP per capita, as well as openness and common language played a significant role, and contrarily distance between trade partners affect negatively total exports of Australia (Rahman, 2009).

One of the related empirical researches has been conducted by Eichengreen et al. (2004), in which the authors intend to study the impact of the growth in China's exports on the export of other Asian countries. In this study, the authors employ the gravity model and obtain bilateral trade volumes between China and Asian countries from the IMF's Direction of Trade Statistics for 12 years commencing with 1990. The findings of the study demonstrate that distance between countries and the geographical mass of trading partners negatively related to the volume of bilateral trade. Moreover, China exports less to landlocked countries compared to countries with access to the world ocean (Eichengreen et al., 2004).

The paper by Binh et al. (2015) uses a gravity model to explore bilateral trade between Vietnam and 60 countries by applying data from 2000 to 2010. Empirical findings provide that the economic size of trade partners of Vietnam, foreign market size, and geographical distance have

a significant and positive impact on bilateral trade between countries in particular economic size has a greater impact. Results also indicate that the distance between trade partners causes negative impacts on bilateral trade.

A study by Blomqvist (2004) attempts to find determinants of the trade flow of Singapore, in particular, trade flow between Singapore and South-East countries. Singapore is considered a "Global city", which indicates that it should not be any significant difference in trade volume with Asian countries and European countries. However, the study revealed that over the last 15 years, closeness (distance) and liberalization of ASEAN countries significantly affects the export trade of Singapore (Blomqvist, 2004).

Montanari (2005) estimates the potential for growth in trade between Balkan countries, Bulgaria, and Romania, and European Union countries since, over the past years, the European Union has taken important steps to determine clear for the integration of Balkan countries. By again applying the Gravity model, Montanari (2005) empirically showed that as a result of being a member of the EU, trade flow between Balkan countries, Romania and Bulgaria, and European Union increased significantly as well as geographical proximity contribute trade flow positively between these trade partners

Since natural resources comprise significant parts of Azerbaijan exports it worth looking at some trade patterns and determinants of oil exporters' countries. Khayat (2019) empirically investigates determinants of Gulf Cooperation Council Countries' trade patterns based Standard Gravity Model using data 2001-2012. Empirical findings showed that GDP per capita and population for GCC and destination countries was significant. Unlike Khayat (2019), we will attempt to analyze the total export and non-oil export separately

3. DATA AND METHODOLOGY

We use the World Bank, WITS, and CEPI (Centre d'Etudes Prospectives et d'Informations Interna-tionales - French: Institute for Research on the International Economy) datasets to construct a model. Panel data contains bilateral trade flow between Azerbaijan and 11 main trade partners, namely Switzerland, China, Czech Republic, Germany, India, Israel, Italy, Russia, Ukraine, United States during the years between 2000 and 2019. These countries are main trade partners, which contain more than 70% of the total export and total export of Azerbaijan. The observation size is 220. We use total bilateral trade, bilateral exports, and bilateral imports, non-oil export as a dependent variable separately. The reason for using non-oil export separately is because that the export of oil-sector consists more than 90% of total export (2018). The definition of all variables is given in Table 2.

3.1. Variables

In pursuit of the literature, the traditional gravity model approach has been used. Taking bilateral trade flows, export, import, and non-oil export as the dependent variable, we consider market size, wealth, and distance as independent factors. Even though the literature suggests considering total trade value (import+export) as the most appropriate for the dependent variable, to have a clear understanding, we will also run additional separate regressions for export, import, and non-oil export.

Gross Domestic Product – as an indicator of the size of the economy, a larger economy means a greater variety of products for trade. In terms of economy of scale and differentiated products,

market size (GDP) has a crucial effect on the volume of bilateral trade (Paass, 2000). GDP for both origin and destination country has been included in the model. Data has been extracted from WITS (World Integration Trade Solution)

Gross Domestic Product per capita – To explore the dependency of trade on wealth factor GDP per capita is a widely-used measure in the gravity model (Bergstrand, 1989), (Sanso, Rogelio and Sanz, 1993), (Tamirisa, 1999), (Cheng and Wall, 2005). The study suggests that richer countries receive a major share of foreign direct investment (Felipe & Kumar, 2010). Thus, it means that GDP per capita has a positive impact on trade for both host and destination countries. This data also has been extracted from WITS.

Table 2: Definitions of the variables

Variables	Definitions
$Tvalue_{ij}$	Total trade value of bilateral trade (export + import) between the source and destination countries
$LnTvalue_{ij}$	Total trade value of bilateral trade (export + import) between the source and destination countries in natural logarithm form
$Export_{ij}$	Total export from origin to destination country
Ln $Exporti_{ij}$	Total export from origin to the destination country, in natural logarithm form
$Import_{ij}$	Total import from destination to the origin country
Ln $Import_{ij}$	Total import from destination to origin country in natural logarithm form
Oil_export	Export of oil and oil products from origin to destination country
Ln Oil_export	Export of oil and oil products from origin to destination country in natural logarithm form
NonOil_export	Export of non-oil products from origin to destination country
Ln NonOil_export	Export of non-oil products from origin to destination country in natural logarithm form
GDP_O_i	GDP for the origin country
Ln GDP_O_i	GDP for the origin country natural logarithm form
GDP_D_j	GDP for the destination country
Ln GDP_D_j	GDP for destination country natural logarithm form
$PCGDP\_O_i$	GDP per capita for the origin country
Ln $PCGDP\_O_i$	GDP per capita for the origin country natural logarithm form
$PCGDP\_D_i$	GDP per capita for the destination country
Ln $PCGDP\_D_j$	GDP per capita for the destination country natural logarithm form
POP_O_i	Population for the origin country
Ln POP_O_i	Population for the origin country natural logarithm form
POP_D_j	Population for the destination country
Ln POP_D_j	Population for the destination country natural logarithm form
$Land_i$	Land size for the origin country
Ln $Land_i$	Land size for the origin country natural logarithm form
$Distance_{ij}$	Geographical distances (miles) between the origin and destination countries
Ln $Distance_{ij}$	Geographical distances (miles) between the origin and destination countries natural logarithm form

Population size - is also another indicator of economic size in terms of receiving and sending foreign direct investment. Although the effect of population on trade can be both positive and negative in different studies, considering Azerbaijan as a Caucasus country, we expect this variable positively correlated with trade (Khayat, 2019). Population data has been taken from World Bank.

Distance – is the length of distance as a kilometre between the capitals of host and source countries. Study shows that geographical distance is a proxy for transportation costs (Frankel, 2002). Considering shipping costs to be increasing by the distance in terms of time lags, spoilage, and information costs regarding legal and administrative procedures with the partner country, we predict a negative relationship with trade flow. However, some scholars suggest the opposite approach about distance facto. For example, a study by (Bougheas et al., 1999) shows that distance is not a significant factor for trade anymore due to recent advancements in transportation. To have any insight for the study, we will include this variable in the model. Data for distance is conducted from CEPII.

Land area – The land area (in square km) is a country's total area, excluding area under inland water bodies, national claims to continental shelf, and exclusive economic zones. In most cases, the definition of inland water bodies includes major rivers and lakes. Land area is expected to have a positive relationship with the trade. The data for the land area is taken from the World Bank. All above-mentioned variables are taken in natural logarithm form.

3.2. Gravity model

The gravity model has been widely used in economic and social sciences to analyze spatial interactions among different variables (Sen and Smith, 2012). Its name comes from the general idea of gravity theory in physics by Isaac Newton but used for international trade by Tinbergen (1962). Considering the size of economies as "mass" of entities, the gravity model explores the magnitude of trade between countries (''physical entities'' analogically). According to Tinbergen (1962) and Poyhonen (1963), the basic gravity model is as follow:

$$Trade_{i,j} = \alpha \frac{GDP_i * GDP_j}{Distance_{i,j}}$$

$Trade_{ij}$ is bilateral trade value between origin country with index and destination country with index j where GDP shows the size of economy respectively. $Distance_{ij}$ is just the length between the capitals of source (i) and host (j) countries. By taking natural logarithm form and modifying the equation (1), we get the linear form of gravity model:

$Ln(Trade)_{i,j} = \alpha + \beta 1 * ln(GDP_i * GDP_j) + \beta 2 * ln(Distance)_{ij} + u_{ij}$

In this model, α, $\beta 1$ *and* $\beta 2$ are estimators and u_{ij} is error terms capturing the possible shock and chant events that may impact bilateral trade. Based on core model (2), we include our variables and modify the model in the following way:

a) $ln(Tvalue_{ijt}) = \alpha 0 + \beta 1 ln(GDP_{ijt}) + \beta 2 ln(PC\_GDP_{ijt}) + \beta 3 ln(POP_{ijt}) + \beta 4 ln(Land_{ij}) + \beta 5 ln(Distance_{ij}) + u_{ijt}$

b) $ln(Export_{ijt}) = \alpha 0 + \beta 1 ln(GDP_{ijt}) + \beta 2 ln(PC\_GDP_{ijt}) + \beta 3 ln(POP_{ijt}) + \beta 4 ln(Land_{ij}) + \beta 5 ln(Distance_{ij}) + u_{ijt}$

c) $ln(Import_{ijt}) = \alpha 0 + \beta 1 ln(GDP_{ijt}) + \beta 2 ln(PC\_GDP_{ijt}) + \beta 3 ln(POP_{ijt}) + \beta 4 ln(Land_{ij}) + \beta 5 ln(Distance_{ij}) + u_{ijt}$

d) $ln(Non\text{-}oil\_Export) = \alpha 0 + \beta 1 ln(GDP_{ijt}) + \beta 2 ln(PC\_GDP_{ijt}) + \beta 3 ln(POP_{ijt}) + \beta 4 ln(Land_{ij}) + \beta 5 ln(Distance_{ij}) + u_{ijt}$

*i - shows origin country, j- destination country, and t- time dimension.

Despite classic gravity, the model uses cross-section data for trade in a given year and for given countries, using panel data has some advantages. First of all, panel data allows us to control β-unobservable individual effects to heterogeneous trading relationships. Second, with panel data,

it is possible to observe relevant relationships over the years, and we can remove the risk of choosing an unrepresentative year (Antonucci and Manzocchi, 2006). To follow the literature, we apply panel regression by using the Fixed Effect and Random Effect model. If we choose the trade partners randomly among a large group of the population, then the Random Effect model would be appropriate. However, when we select predetermined countries such as the main trade partners of Azerbaijan, it is suggested to Fixed Effect model (Egger, 2002). However, we will present the results based on the Hausman test.

4. ESTIMATION RESULTS

Table 3 represents summary statistics for dependent and independent variables covering the entire sample. Table 4 indicates a choice of method test results. According to the Hausman test and Breusch-Pagan test, the Random Effect model is appropriate. The main results of RE model tests are given in Table 5.

Table 3: Summary Statistics

Variables	Mean	St. dev	Min.	Max.
$LnTvalue_{ij}$	13.08	1.61	7.69	16.78
$Ln\ Export_{i}$	11.75	2.68	0.52	16.78
$Ln\ Import_{ij}$	11.97	1.54	7.56	14.64
Ln Oil_export	11.5	3.25	-3.91	16.78
Ln NonOil_export	9	2.3	0.52	13.43
$Ln\ GDP\_O_{i}$	23.88	0.54	22.38	24.61
$Ln\ GDP\_D_{j}$	8.02	0.86	6.48	8.97
$Ln\ PCGDP\_O_{i}$	8.02	0.86	6.48	8.97
$Ln\ PCGDP\_D_{j}$	9.12	1.4	6.09	11.39
$Ln\ POP\_O_{i}$	16	0.07	15.9	16.12
$Ln\ POP\_D_{j}$	18.18	1.74	15.65	21.06
$Ln\ Land_{i}$	13.42	2.18	9.98	16.61
$Ln\ Distance_{ij}$	7.97	0.53	7.28	9.18

Source: *author's own calculation*

The findings indicate that GDP per capita for destination and origin country has a significant positive impact on bilateral trade, which is consistent with the literature. Besides, Land is positively correlated with trade while other variables such as GDP and Population have insignificant p-value. Interestingly, the distance factor is also insignificant. We explain this phenomenon by a large share of products which is insensitive to geographical and distance factor (more than 90% of total export consist of oil and oil products) (Martinez-Zarsozo, 2004). Because that oil export is based on long-term contracts, and the economy's trade structure is not largely diversified, the insignificance of the distance factor is reasonable. That is why we separately analyze the non-oil sector in which the results find a negative impact of distance on non-oil export.

4.1. Results of gravity equation for export and import

Regarding the structure of trade, we consider that analyzing export and import values separately will give us more insights. The results show that only GDP per capita and Population of origin country has a statistically significant and positive impact on export. When we run the regression for only import, the results are more interesting. While 1 % rise in GDP per capita for destination

country causes by 0.23 % increase in Import value, for origin country, this figure is 0.53%. Moreover, the impact of the population size of source and partner country on both export and import is positive with high significance. This result also verifies our hypothesis (Papachashvili, 2018). Additionally, land area is positively correlated with import value.

Results of gravity equation for Non-Oil export:

The study suggests that the products which are highly sensitive to geographical and distances factors could be better explained by the gravity model. That is why we excluded the Oil sector from total export to obtain Non-oil export and then run the regression. 1% rise of GDP per capita for destination and origin country leads to increase in Non-Oil export by 0.67% and 0.51% respectively. The results verify that the richer the country, the higher the volume of non-oil export. In addition, while land and population of origin country are positively associated with non-oil export, the distance factor is found to be negatively correlated.

Table 4: Choice of Method Test Results

Specification	F-test p -value	Breusch-Pagan test p-value	Hausman test p-value
Total trade	0	0	0.8592
Export	0	0	0.9521
Import	0	0	0.9774
Non-Oil export	0	0	0.9866

Table 5: Gravity Equations, Panel Analysis 2000-2019

Depen. Var.	**Bilateral trade**	**Export**	**Import**	**Non-Oil export**
Indepen. Var.	**RE(GLS)**	**RE(GLS)**	**RE(GLS)**	**RE(GLS)**
LnGDP_D	-0.0721 (0.3)	0. 63 (0.342)	-0.052 (0.796)	0.421 (0.298)
LnPOP_D	-0.034 (0.921)	0.221 (0.744)	-0.416 (0.188)	-0.379 (0.397)
LnPC_GDP_D	0.44** (0.025)	0.492 (0.342)	0.23* (0.070)	0.67*** (0.003)
LnLand	0.47* (0.070)	0.338 (0.51)	0.82*** (0.001)	1.27*** (0.000)
LnDist	-0.73 (0.217)	-1.28 (0.272)	-0.455 (0.431)	- 1.62*** (0.039)
LnGDP_O	0.612	-0.27 (0.173)	0.022 (0.72)	0.072 (0.559)
LnPOP_O	0.959	10.67* (0.000)	4.08*** (0.000)	10.85*** (0.000)
LnPC_GDP_O	0.79*** (0.000)	0.51*** (0.039)	0.52*** (0.000)	0.51*** (0.001)
Const.	15.20 (0.513)	- 176*** (0.000)	- 58.6*** (0.000)	- 176.9*** (0.000)
No. Obs.	220	220	220	220
Wald Chi2	234.12*** (0.000)	170.85*** (0.000)	610.48*** (0.000)	141.67*** (0.000)
R2 (within)	0.5312	0.4535	0.7447	0.3685
R2 (between)	0.3723	0.214	0.68	0.7844
R2 (overall)	0.4593	0.3531	0.7032	0.6773

*P-value in parentheses, *significant at 10%, **significant at 5%, ***significant at 1%*
Source: *Authors' own calculations*

CONCLUSION

This paper applies gravity model analysis to explore factors influencing the trade patterns of Azerbaijan. We run panel regression is run to explore trade interactions with the size of the economy, distance, and welfare. Using WITS and CEPII datasets by the years 2000-2019, bilateral trade, export, import, and non-oil export has been used as dependent variables separately. The results indicate that richer the country means more trade. Unlike the literature, the distance factor has no significant impact on bilateral trade, total export and total import. We explain this result by a large proportion (oil export contains more than 90% of total export) of geographical and distance insensitive products. However, the gravity model better explains non-oil export rather than total export, total import, and bilateral trade. While GDP per capita for the origin and destination countries and land factors are positively correlated with non-oil export, distance is found to have a negative impact.

Policy implications

Even though the gravity model partially explains the bilateral trade patterns of Azerbaijan, it gives more insights in terms of sectorial analysis, such as the non-oil sector. Considering a large proportion of oil export in total export, Azerbaijan economy needs diversification, especially in the non-oil sector. Because distance negatively affects non-oil exports, policymakers should focus on decreasing the shipping costs of exporting non-oil products.

Limitations and Further extension

As usual, the main drawback of the study is due to insufficient data in terms of trade partners. Including more countries such as Georgia, Iran, Turkmenistan, Kazakhstan, Uzbekistan and others into the model would allow us to explore additional variables. Because the Fixed Effect model omits time-invariant variables, we could not analyze interaction with dummy variables such as common border, land-lock and membership to trade organizations. In addition, to have a better understanding of these interactions, using trade patterns by sectorial clusters would be appropriate.

REFERENCES

1. Andrews, F. M. (1974). Social indicators of perceived life quality. *Social indicators research*, *1*(3), 279-299.
2. Antonucci, D., & Manzocchi, S. (2006). Does Turkey have a special trade relation with the EU?: A gravity model approach. *Economic Systems*, *30*(2), 157-169.
3. Bergstrand, J. H. (1989). The Gravity Equation in International Trade: Some Microeconomic Foundations and Empirical Evidence. *Review of Economic and Statistics*, 67(3), 474-481.
4. Binh, D.T.T.,Duong, D.V., and Cuong, H.M. (2015). Applying Gravity Model to Analyze Trade Activities of Vietnam. *Open Journal of Social Sciences*, 4(5).
5. Blomqvist, H. C. (2004). Explaining trade flows of Singapore. *Asian Economic Journal*, *18*(1), 25-43.
6. Bougheas, S., Demetriades, P. O., & Morgenroth, E. L. (1999). Infrastructure, transport costs and trade. *Journal of international Economics*, *47*(1), 169-189.
7. Cheng, I.-H., & Wall, H. J. (2005). Controlling for Heterogeneity in Gravity Models of Trade and Integration. *Working paper, Federal Reserve Bank of St. Louis*. 87, 49-63.
8. Comtrade, U. (2018). Azerbaijan Service Trade.
9. Egger, P. (2000). A note on the proper econometric specification of the gravity equation. *Economic Letters*. 66(1), 25-31
10. Egger, P. (2002). An Econometric View on the Estimation of Gravity Models and the Calculation of Trade Potentials. *The World Economy*, 25(2), 297-312

11. Eichengreen, B., Rhee, Y., and Tong,H. (2004). The Impact of China on the Exports of Other Asian Countries. *National Bureau of Economic Research*. Working paper 10768. DOI 10.3386/w10768
12. Felipe, J., & Kumar, U. (2010). The role of trade facilitation in Central Asia: A gravity model. *Levy Economics Institute of Bard College Working Paper*, 628.
13. Frankel, J., & Rose, A. (2002). An estimate of the effect of common currencies on trade and income. *The Quarterly Journal of Economics*, *117*(2), 437-466.
14. Hasanov.F. (2010). The Impact of Real Oil Price on Real Effective Exchange Rate:The Case of Azerbaijan. *DIW Berlin Discussion Paper No. 1041*.
15. Hovakimyan, G. (2016). Exploring foreign trade of Armenia from 2011 to 2015: Gravity model of trade. *Manoogian Simone College of Business and Economics. In partial fulfillment of the requirements for the degree of Master of Science in Economics.*
16. Ismailzade, F. (2005). Turkey-Azerbaijan: the honeymoon is over. *Turkish Policy Quarterly*, *4*(4), 67-80.
17. Martínez-Zarzoso, I., & Nowak-Lehmann, F. (2003). Augmented gravity model: An empirical application to Mercosur-European Union trade flows. *Journal of applied economics*, *6*(2), 291-316.
18. Mikayilov, E. (2009). The Global Economic Crisis and Azerbaijan. *Turkish Policy Quarterly*, *8*, 102-111.
19. Montanari, M. (2005). EU Trade with the Balkans : Large Room for Growth? *Eastren European Economics*, 43(1), 59-81
20. Musayev, A., and Aliyev, K. (2017). Modelling Oil-Sector Dependency of Tax Revenues in a Resource Rich Country: Evidence from Azerbaijan. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*. 65(3), 1023-1029.
21. Osman N.A, Suleymanov. E, and K. Mammadov (2016). *Economy of Azerbaijan : 25 years of independence.* Baku: Sharg-Garb.
22. Papachashvili, N., Jamagidze, L., & Melitauri, N. (2018). The Analysis of Export Drivers and Impediments Using Extended Gravity Model (The Case of Georgia). *Economic Alternatives*, (1), 69-85.
23. Paas, T. (2000). Gravity approach for modeling trade flows between Estonia and the main trading partners. *University of Tartu, Economics & Business Administration Working Paper*, (4).
24. Pöyhönen, P. (1963). A Tentative Model for the Volume of Trade between Countries. *Weltwirtschaftliches Archiv*, 93-100.
25. Rahman, M. M. (2009). Australia's global trade potential: evidence from the gravity model analysis. In *Proceedings of the 2009 Oxford Business and Economics Conference (OBEC 2009)* (pp. 1-41). Oxford University Press.
26. Khayat, S. H. (2019). A gravity model analysis for trade between the GCC and developed countries. *Cogent Economics & Finance*, *7*(1), 1703440.
27. Sanso, M., Cuairan, R., & Sanz, F. (1993). Bilateral trade flows, the gravity equation, and functional form. *The Review of economics and Statistics*, 75(2), 266-275.
28. Sen, A., & Smith, T. E. (2012). *Gravity models of spatial interaction behavior*. Springer Science & Business Media.
29. Tamirisa, N. T. (1999). Exchange and capital controls as barriers to trade. *IMF Staff Papers*, *46*(1), 69-88.
30. Tinbergen, J. (1962). *Shaping the World Economy: Suggestions for an International Economic Policy*. Twentieth Century Fund, New York.
31. Thorbecke, W. (2015). Understanding J apan's Capital Goods Exports. *The Japanese Economic Review*, *66*(4), 536-549.
32. World bank. (2018). *World Development Indicators.*
33. Zeynalov, A. (2017). The gravity of institutions in a resource-rich country: the case of Azerbaijan. *International Economics and Economic Policy*, *14*(2), 239-261.