Turkish Online Journal of Qualitative Inquiry (TOJQI)
Volume12, Issue 5, July 2021: 3493-3510

Research Article

Using the gravity model to measure international trade flows in Iraq for the period (2004-2019)

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Abstract

International trade is the backbone of the global economy and the most important link between countries and occupies a prominent position in light of events and rapid changes in a world characterized by complexity and intertwining in relations and the steady trend towards the internationalization of economic life, given that national borders are no longer sufficient for the growth of productive forces and therefore closure will not enable it to achieve its goals Therefore, we find that the use of the gravity model to measure Iraq's trade flows (total exports and imports) is positively determined by the size of economies, the per capita GDP difference for the countries concerned, and the trade openness of the countries and by using Panel Data because the research data is a mixture of cross-sectional data and series data. Timeline

an introduction

International trade has become one of the most important activities on which all countries of the world depend. There is no single country that lives completely self-sufficient for a long period of time. All countries have to specialize in the production and export of a specific commodity or commodities that suit its economic and natural conditions that allow it to have an advantage. Relative in the production of these commodities, and then export them to countries that cannot produce them within their borders, or if they produce them, the costs of production will be greater than the costs of importing them. As for Iraq's exports, they are one substance, which is oil exports. As for its imports, they are many and varied. This research included the most important Foreign trade indicators of the Iraqi economy represented by exports, imports and trade balance (2004-2019).

Research problem

International trade occupied an important position in pushing countries to develop their economies, which requires analyzing the reality and nature of international trade flows in Iraq and diagnosing the priorities of trading partners to ensure the optimal exploitation of economic resources, as Iraq still depends on oil for its exports with the outside world.

Research goal

The research seeks to achieve a set of main objectives, the most important of which are

1.Identify the methods and applications of the gravity model to Iraq's trade flows with its main trading partners.

2.Measuring the main factors affecting the trade flows of Iraq and the interpretation of the volume of exchange with different countries using the Jathiya model.

Research Hypothesis

The research stems hypothesis that: Iraq's total international trade is finally determined by the size of the economy, the total demand for imports from partner countries, and the trade openness to the world.

Theoretical aspect: the concept of international trade and the gravity model

1. The concept of international trade

International trade is the exchange of goods and services and their movement across borders and different regions, and it constitutes a large share of the gross domestic product in various countries (1). International trade is one of the branches of economics that studies international economic transactions, such as the movement of goods, services and various capitals.

Some have defined it as one of the branches of economics that is concerned with the study of economic transactions, represented by the movement of goods, services and capital, and the migration of individuals, as well as the trade policies applied by every country in the world to influence this phenomenon.(2)

It can also be defined as the exchange of property, services or values of the economy between countries or at least two countries.

2.International trade policies

It is a set of measures taken by the state in the field of international trade with the aim of achieving some goals. The state chooses a specific and specific destination in its trade relations with abroad (freedom or protection), and this is considered by issuing legislation and taking decisions and procedures that put it into practice.

It is also known as "a set of official legislation and regulations that the state uses to control international trade activity in various developed and developing countries of the world, and which works to liberate or restrict commercial activity from the various obstacles it faces at the international level among a group of countries.(3)

There are two main types of trade policies.

A- Free Trade Policy

The naturalists in the eighteenth century were the first to call for the liberation of trade and the non-interference of the state in commercial activity, that is, to leave commercial activity free, violating the policy of the merchants, because in that liberation is in the interest of society, and they also called for the application of that economic policy at home, which was reflected With the slogan “Let him work” laisses-Faire, and in the field of international trade relations, it was reflected in the slogan “Let him pass” Laisses-Passer, which means that I let people work freely and let goods and production elements pass freely across the border.(4)

This policy represents "the removal of all restrictions and obstacles imposed on the movement of goods and services from one country to another.(5)

Hence, we conclude that the policy of commercial freedom ensures that the government does not interfere in international trade, as this does not mean abolishing the state, but rather reducing its interference to the lowest possible level, because trade between peoples is an inheritance that was found in the presence of human beings. To internal trade, it is a manifestation of human cooperation with human brotherhood, regardless of the geographical and political borders that separate them.(6)

B- Trade Protection Policy

The roots of protection extend back to the era of the Merchants, which extends from the late sixteenth century until the end of the eighteenth century. This doctrine of trade protection was defended by quite a few economists during the nineteenth century, the most important of which was the German (Friedrich List) in 1840. He also defended the protectionism of trade. This trend in the Roman twentieth century (not) in 1920 in writing the label (protectionist theory and international exchange), and they did not deny at all the freedom of trade exchange because of its positives on the economy and global trade, protection according to them does not mean a period of time through which the new emerging countries go through , in order to allow these developing nations to bridge and correct the strength of industrial backwardness compared to the great countries (7). Through this, we will address the concept or content of protectionism in international trade policy:

It builds countries for a set of laws and legislations, and takes the measures implemented for them with the aim of protecting their local goods or market against the danger of foreign competition, and then the government restricts the freedom of trade with other countries by following some methods such as imposing customs duties on imports or setting a maximum limit for the share of imports during a period of time specific, which provides a kind of protection for local activities from foreign competition.(8)

3.International Trade Policy Objectives

There is a set of goals that the state seeks to achieve through its commercial policy, some of which are of an economic nature, some of them are of a social nature, and some of them are also of a strategic nature. Through that, these goals were divided into three main groups, represented by the following:

1.Economic objectives: They are(9)

A- Protecting national industries from foreign competition, especially emerging national industries, when appropriate and supportive conditions must be provided for them.

b- Increasing the state’s financial resources and using these resources to finance the state’s public expenditures in all its forms and types.

T- Protection of the national economy from external fluctuations that occur outside the scope of the national economy, such as cases of deflation and inflation, as well as protection from the danger of dumping policies, which represents price discrimination in the field of international trade, i.e. selling at a price lower than production costs.

d- Working to fix the deficit in the balance of payments and bring it back to balance.

2.Social goals: they are represented in.(10)

.A - Redistribution of national income among the different classes and classes

b- Protecting the interests of some social groups, such as the interests of farmers or producers of certain commodities that are necessary or essential in the state.

3.Strategic objectives: They are

A - Securing self-sufficiency, especially food security.

b- Providing the greatest amount of exploitation and security in the state in terms of economic and military terms.

Second: the concept of gravity model

The term gravity goes back to the physicist Isaac Newton, the author of the first model of gravity, which is a common model in the statistical analysis that resulted in the measurement of binary flows between two geographical environments, and the content of the law of gravity which states that the force of attraction But the use of the model is not limited to physics only, where a modified version of Newton's law of universal gravitation can help explain the flow of trade between the two countries is directly proportional to the product of the total product The local area of the two countries and inversely with the square of the geographical distance between those two countries.(11)

The gravitational equation can be written as:

$$F_{ij} = \frac{G \times N_i \times N_j}{D_{ij}} \dots \dots \dots (1)$$

Whereas:

: The flow of trade (exports or imports) from country (i) to country j F_{ij}

.: expresses the economic size of the two countries, as measured by the GDP of countries i and j$N_i \times N_j$

: the distance (in kilometers or miles) between the two countries, which is an indicator of the cost of D_{ij} trade.

As for the stages that the gravity model has gone through in international trade, they are as follows:

1. **William Joseph Reilly**

Reilly used the law of gravitation to create an application of the gravitational model in 1931 to measure the force of attraction in trade in large cities, where he used patterns of the number of shopping trips and retail trade in order to determine trade areas for a number of American cities, by using the variables of the distance between the studied neighborhoods and the nearby markets, and the number of Families in each neighborhood (12), and Riley put the following model:

$$S = \frac{G \times R \times K}{D^2} \dots \dots \dots (2)$$

Whereas:

: the flow of trade in the individual between two cities$S$

: a fixed number$K$

: the total number of trips attracted by the shopping place$R$

: the number of shopping trips generated$G$

: distance in miles$D$

We note from the mathematical formula of the gravity model of retail sale used by the economist Riley, the number of shopping trips between two cities is directly proportional to the population in the city and inversely proportional to the distance between the city and the market, meaning that the greater the number of people in the two cities, the greater the volume of shopping between them, while the greater the distance The spatial represented in the distance between these two markets in a way that leads to a high cost of transportation, which leads to a decrease in the volume of shopping.

2.Logarithm ISARD Model

The economist Walter Isard introduced in 1954 the development and use of the gravity model presented by the economist Riley for the purpose of evaluating the effectiveness of trade agreements between countries on foreign trade. The basic model for trade between two countries takes the following equation:

$$F_{ij} = G\frac{N_i \times N_j}{{D_{ij}}^2} \dots\dots\dots (5)$$

Whereas:

: represents the volume of trade from country i to country jF_{ij}

: usually represents the GDP of countries i and j$N_i \times N_j$

: represents the distance between the two countries i and jD_{ij}

: the number of the constan G

The gravity model presented by ISARD was used according to the above relationship in the standard analysis, and then transformed this equation into a linear function for the purposes of economic analysis by employing the logarithm (Ln). Where the equation becomes in its linear form

$$\text{Ln}\,(\text{F}_{\text{ij}}) = \text{Ln}\left(\text{G}\frac{\text{N}_\text{i}\times\text{N}_\text{j}}{{\text{D}_\text{ij}}^2}\right) \text{.....(6)}$$

Which equals the following:

$$\text{Ln}\,(\text{f}_{\text{ij}}) = \alpha_0\text{Ln}(\text{G}) + \alpha_1\text{Ln}(\text{Ni}) + \alpha_2\text{Ln}(\text{Nj}) - \alpha_3\text{Ln}\left({\text{D}_\text{ij}}^2\right) + \varepsilon\text{.....(}$$

Notes in this linear equation interpretation of the logarithm of international trade flows from exports or imports, and this equation depends on three dependent variables represented in the logarithm of the size of the economy of the exporting country and the logarithm of the size of the economy of the importing country and the logarithm of the distance between them. The parameters of the model α_1, α_2 and α_3 can be used as a measure of the elasticity of trade flows to explain the level of the size of the economies of countries or the distance between the two countries, as if the size of the economy of the first country increases by 1%, the exchange rate between the two countries will increase by α_1, and also if the size of the country's economy increases the second by 1%, the rate of trade exchange between the two countries will increase by α_2, and if the distance between the two countries increases by 1%, the volume of trade exchange between the two countries will decrease by α_3.(13

3.The Jean Tinbergen Social Interactions Model：

Jean Tinbergen began by presenting the mathematical model based on Newton's law of "general gravitation" and the results of work and research reached by precedents from economists, especially those related to or attributed to the economist Walter Isard, and he called the Social Interactions Model, which ensures A group of variables such as immigration, tourism, foreign direct investment (). Economist Jan Tinbergen suggests starting from the Israd model, to formulate a model about the universal law of gravitation in social interactions:

$$F_{ij} = G\frac{N_i \times N_j}{D_{ij}^2} \dots\dots\dots (8)$$

$$F_{ij} = G\frac{N_i^{\alpha} \times N_j^{\beta}}{D_{ij}^{\theta}} \dots\dots\dots\dots (9)$$

whereas*:*

$\alpha = \beta = 1$, $\theta = 2$

: represents the volume of trade from the country of origin (i) to the destination country (j) or the F_{ij} .total amount of interactions between the two countries

: usually represents the gross domestic product of countries (i) and (j)N_i وN_j

: represents the distance between states (i) and (j)D_{ij}

: the number of the constantG

Tinbergen explained here that if country (i) is the country of origin, then (N_i) represents the total quantity of goods and services that he wants to offer to all customers in the meantime, then (〖N〗_j) . *(* represents the total quantity of demand by the second country, which is (j

4.model James Anderson

Anderson in 1979 made the first attempt to derive the gravitational model using Cobb-Douglas preferences, and then used the Constant Elasticity of Substitution (CES) preferences This study relied on the following hypotheses.(14)

1.Armington's hypothesis, through which the differentiation between commodities is made due to the different sources of production. The consumer determines a certain level of spending on a particular commodity and then distributes his needs of this commodity to different sources according to his preferences

2.every country is in a state of full specialization, whether across sectors or between industries

3.homogeneity and symmetry of consumer preferences with utility functions of the form of the Cobb-de-Glass function. That is, all countries spend equal shares of their income on goods and we symbolize them with the symbol φ where φφ

It is a function of income, population number and other factors. The study will be limited to income and population in order to simplify the model

)…….(11)$\varphi_i = f_i(M_i , Z_i$

)……(10)$\varphi_j = f_j(M_j , Z_j$

Whereas:

: the amount of income spent by country j on each commodity from any source, let it be country I φ_j

Country j's imports of goods from country i have the following formula:

……..(12) $X_{ij}Y_{ij} = \varphi_i \mu_i(Y_j)t_i$

The basic condition of the budget requires that the state j spends on the goods of state i equal to the income of state i, so the equation becomes as follows:

$$X_i\theta_i = \mu_i(Y_j)\sum t_j \varphi_i \dots\dots\dots\dots (13)$$

And by extracting the value of μ_i from the previous equation, we find:

$$\mu_i(Y_j) = \frac{t_i \varphi_i}{\sum_j \frac{1}{Y_{ij}} t_j \varphi_i} \dots\dots\dots\dots . (14)$$

Substituting the value of 〖_i〗 into equation (1), we get:

……..(15) $X_{ij} = \frac{1}{Y_{ij}} \frac{t_i \varphi_i t_j \varphi_j}{\sum_j \frac{1}{Y_{ij}} t_j \varphi_i} = \frac{t_i \varphi_i t_j \varphi_j}{\sum_i \sum_j x_{ij}}$

By writing the previous equation by substituting 〖φ_(j),φ〗_(i), in addition to the error term that expresses other variables not included in the model, and for measurement and determination errors, we find

$$X_{ij} = \frac{1}{Y_{ij}} \frac{t_i f(t_i . N_i) t_j f(t_J, N_J)}{\sum_j \frac{1}{Y_{ij}} t_j f(t_J, N_J)} U_{IJ} \dots\dots (16)$$

Through the equation, we notice that the denominator is the expenditure for the total of the countries in the world, it is equal to the world income by putting the denominator= K

$$X_{ij} = \frac{1}{K} \frac{t_i f(t_i . N_i) t_j f(t_J, N_J)}{Y_{ij}} U_{ij} \dots\dots\dots (17)$$

From the linear form of the function f(..) of the Cobb-de-Glass type, we find:

…….(18) $X_{ij} = \frac{C}{K} t_i^{\propto} N_j^{\beta} t_j^{\gamma} N_j^{\delta} Y_{ij}^{\rho} U_{IJ}$

It represents the gravity equation, which includes transportation costs

Application side

First: A theoretical introduction to panel data analysis

1.Introducing Panel Data Forms

Panel data models: time-sectional panels in the current decade have gained great interest in economic research and studies because they take into account the effect of the change in time, as well as the effect of the change in cross-sectional observations. It is defined as cross-sectional observations

measured in certain periods of time. And the use of table data models gives it many advantages, compared to the use of cross-sectional data models alone or the use of time-series models alone, including these advantages:

Controlling the problem of special heterogeneity that may appear in cross-sectional data or time series.

Its efficiency is better and the degrees of freedom increase, with less linear multiplicity between the variables, as well as more informational content if cross-sectional data or time-series are used individually.

It allows controlling variables that cannot be monitored or measured, such as cultural factors or those variables that change over time, but not across entities, for example: federal regulations, international agreements ... etc.

It addresses the problem of some obstacles in data collection problems: sampling, design, coverage, and lack of response in smaller samples

It allows identification of causal effects within weak assumptions compared to cross-sectional data.

The second requirement. Panel Data Estimation Methods

First. Common Constant

It is called the pooled least squares estimation method or pooled OLS

This estimation method is one of the simplest estimation methods for this type of data. Where all the transactions are fixed to collect the time periods, ie neglecting any effect of time. The explanatory or independent variables in each time period are not related to the individual error in each time period, and the combined least squares estimate can be considered unbiased POLS is unbiased only if the explanatory variable x_it is independent of both error components. The method of ordinary least squares (OLS) is used to estimate the parameters of the model.

Second. Fixed Effects Method

The fixed effect method is defined as the method that allows studying the effect of the behavior of the variables under study or the effect of change over time for the collected data. The behavior of variables and time is studied in the fixed effect method through the constant term or the α-intercept term in the regression equation. The constant section changes for each sectional unit, the time unit, or both. Based on the assumption that each of these units has its own unmeasured characteristics within the independent variables in the model. In order to take into account the different sections, dummy variables are used with what is known as Least Suares for Dummy Variables (LSDV). Under the fixed effect method, the causal effect occurs under the weakest assumptions, and the stability of time allows for unobserved homogeneity:

$$y\_it= \alpha\_it+ \beta\hat{},x\_it+ \varepsilon\_it \ldots\ldots (1)$$

One of the advantages of the fixed effect method is that it allows a correlation between the special effect of the units and the independent variables. However, the main negative in its use lies in the loss of degrees of freedom with the number of cross-sectional data, as a result of using dummy variables with the number of cross-sectional data, the number of years, or both. In light of the foregoing, it is preferable to use the fixed effect method in the relatively small sample size.

Third . Random Effects Method

The third alternative or the third method is to use the random effect method, also called the variance components method, or the ECM method, as it is assumed that the intersection or constant term is a random sample drawn from a larger population of which it has a fixed expected value. It can be expressed in the following form:

$$\alpha\_1i= \alpha\_1+ \varepsilon\_i \dots (2)$$

Since ε_i has an expectation equal to zero and a variance of σ^2 that is, the drawn sample is part of a larger population that contains all similar units and a common expectation of α_1 and the difference in the fixed term is expressed through the error term ε_i. This method is used in the analysis of tablet data when one assumes that there are no fixed effects, that is, there are individual effects. The random effect method is a special case of the constant effect method. This method helps to control unobserved heterogeneity:

$$y\_it= \alpha\_it+ \beta\^,x\_it+ \varepsilon\_it \dots\dots (3)$$

Under the fixed effect method, the error term ε_it has a normal distribution with a mean of σ^2 ε and for the parameters of the fixed effect method to be correct and unbiased, it is usually assumed that the error variance is constant, that is, homogeneous for all cross-sectional observations, and there is no autocorrelation during time between each group A total of cross-sectional observations in a specified period of time.

The random effect method is an appropriate method in the event that there is a defect in one of the aforementioned hypotheses in the fixed effect model .

Fourth, the choice between the method of fixed effect and random effect

The difference between the fixed and random effect methods lies in the way of looking at the special effect of individual units. In the fixed effect method, this effect is considered as a part of the intercept limit, but in the random effect method, it is considered as a part of the random Eerier limit.

In general, the choice between the fixed and random effects is based on the nature of the relationship between the special effect of the units and the independent variables. If it is assumed that there is no correlation between them, then the use of the random effect is better because it does not lead to a loss of degrees of freedom. But in the case of assuming a correlation between the special effect of the units and the independent variables, use

1.Characterization of the gravity model of Iraq's international trade (exports + imports

As for the model (1), we have based on the studies of Frankel (1993), Sharma and Chua (2000) and Hassan (2000, 2001). Since the dependent variable in the gravity model is total trade (the sum of exports and imports) between pairs of countries, the GDP per capita and the product of the difference between the per capita GDP of the two countries were used as independent variables. We have added some additional independent variables in our model. Thus, the gravity model of trade in this research is:

$$\log (Xijt) = \alpha0 + \alpha1\log (GDPjIt) + \alpha2 \log (PCGDPjIt) + \alpha3 (PCGDPIt - PCGDPjt) \alpha4 \log (TcostjIt)$$
$$(+ \alpha5 \log (Di stanceij) + \alpha6 (TR/GDPiIt) + \alpha7 (Borderij) + \alpha8 (j\text{-}LOAS) + \alpha9(j\text{-}LOAS) + Uijt \dots (8$$

: whereas

X ij = total trade between Iraq (country i) and country j

GDPi (GDPj) = GDP of the country i j

PCGDPi (PCGDPj) = GDP per capita for the two countries i, j

PCGDPi - (PCGDPj) = the difference between the per capita GDP of the two countries i j

Tcostij = Economic cost of transportation for country I, j

Distanceij = the distance between country i and country j

ij GDP /= TRij

Borderij = the land border between country i and j (dummy variable

j – LOAS = country j is a member of the League of Arab States (dummy variable*)*

IBA j- = International Bilateral Agreements between country i and country j (dummy variable)

Uij = error limit

t = duration of time

αs = parameters

Assumptions of the first model

The gross domestic product (GDP) reflects the economic activity in the country, so it expresses the size of the economy. The larger it is, the more trade there will be between the two countries; So we expect a positive sign for the GDP coefficient.

-GDP per capita provides a good alternative to the level of development and infrastructure necessary to conduct trade, and as such, the more developed countries are, the more trade between pairs of countries will be (Frankel 1993). Therefore, we expect a positive sign for the coefficient of the per capita GDP variable.

-TCOST The flow of trade is inversely related to transportation costs. Therefore, we expect negative signs for the coefficients of this variable.

-According to the H - O theory, the sign of the PCGDG coefficient will be positive. On the other hand, based on Linder's hypothesis, the sign will be negative.

TR/GDPijt A variable total trade/GDP that indicates the openness of a country. The more open the country, the more trade. So we expect a positive sign for this variable.

2.Gravity equations estimates, model selection and discussion of the results

Table (1) Statistical description of the research variables

lDIS	LX	lGDP	GDPi-GDPj	lPCGDP	lTC	
5110.447	0.938593	3.26E+12	2262.959	21235.17	946.6297	Mean
3860.000	6.785500	1.86E+12	1053.140	11608.04	482.8300	Median
11173.00	1570.150	1.83E+13	12665.84	65297.52	2019.000	Maximum
694.0000	4318.200	2.84E+09	44.51000	157.6826	0.000000	Minimum
3695.359	934.9319	4.25E+12	2830.349	18527.66	868.7605	Std. Dev.
0.225405	1.840100	2.107438	1.819390	0.433427	0.291768	Skewness

1.550144	8.566214	6.641647	5.708464	1.695473	1.262083	Kurtosis
19.78726	382.1867	266.3132	176.6150	21.05686	28.84744	Jarque-Bera
0.000050	0.000000	0.000000	0.000000	0.000027	0.000001	Probability
1052752.	-193.3502	6.71E+14	466169.6	4374444.	195005.7	Sum
2.80E+09	1.79E+08	3.71E+27	1.64E+09	7.04E+10	1.55E+08	Sum Sq. Dev.
206	206	206	206	206	206	Observations

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Table (2) Unit Root Test Panel for International Trade for Iraq for the period 2004-2020

Panel unit root test: Summary
Series: D(X)
Date: 05/29/21 Time: 01:13
Sample: 2004 2019
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Obs	Cross-sections	Prob.**	Statistic	Method
			Null: Unit root (assumes common unit root process)	
169	13	0.0000	-4.87150	Levin, Lin & Chu t*
			Null: Unit root (assumes individual unit root process)	
169	13	0.0001	-3.67652	Im, Pesaran and Shin W-stat
169	13	0.0005	56.0902	ADF - Fisher Chi-square
182	13	0.0000	88.6985	PP - Fisher Chi-square

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Table (3) Unit Root Test Panel Data for the Gross Domestic Product of Iraq and the Most Important Trading Partner For the period 2004-2019

Panel unit root test: Summary
Series: D(GDP)
Date: 05/29/21 Time: 01:31
Sample: 2004 2019
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Obs	Cross-sections	Prob.**	Statistic	Method
		Null: Unit root (assumes common unit root process)		
169	13	0.0000	-4.63840	Levin, Lin & Chu t*
		Null: Unit root (assumes individual unit root process)		
169	13	0.0000	-3.91179	Im, Pesaran and Shin W-stat
169	13	0.0001	61.0516	ADF - Fisher Chi-square
182	13	0.0000	92.6320	PP - Fisher Chi-square

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Table (4) Per capita output for Iraq and international groups
According to geographical distribution for the period 2004-2019

Panel unit root test: Summary
Series: PCGDP
Date: 05/29/21 Time: 01:37
Sample: 2004 2019
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Obs	Cross-sections	Prob.**	Statistic	Method
		Null: Unit root (assumes common unit root process)		
182	13	0.0000	-4.31584	Levin, Lin & Chu t*
		Null: Unit root (assumes individual unit root process)		
182	13	0.0193	-2.06807	Im, Pesaran and Shin W-stat
182	13	0.0091	45.9945	ADF - Fisher Chi-square
195	13	0.0000	68.6568	PP - Fisher Chi-square

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Table (5) Transportation costs between Iraq and the international groups for the first model

Panel unit root test: Summary
Series: D(TCost)
Date: 05/29/21 Time: 01:42
Sample: 2004 2019
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel

Obs	Cross-sections	Prob.**	Statistic	Method
		Null: Unit root (assumes common unit root process)		
156	13	0.0000	-7.27709	Levin, Lin & Chu t*
		Null: Unit root (assumes individual unit root process)		
156	13	0.0000	-5.63499	Im, Pesaran and Shin W-stat
156	13	0.0000	81.9455	ADF - Fisher Chi-square
172	13	0.0000	166.637	PP - Fisher Chi-square

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

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Table (6) Breusch-Pagan, Pesaran scaled and Pesaran CD . test

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 16
Cross-sections included: 13
Total panel (unbalanced) observations: 207
Note: non-zero cross-section means detected in data
Test employs centered correlations computed from pairwise samples

Prob.	d.f.	Statistic	Test
0.0000	78	251.6058	Breusch-Pagan LM
0.0000		13.89959	Pesaran scaled LM
0.7916		-0.264272	Pesaran CD

Table (7) Estimation of the first model Panel Data by EGLS method

Dependent Variable X
Method: Panel EGLS (Cross-section random effects)
Date: 05/25/21 Time: 10:44
Sample: 2004 2019
Periods included: 16
Cross-sections included: 13
Total panel (unbalanced) observations: 207
Swamy and Arora estimator of component variances

Prob.	t-Statistic	Std. Error	Coefficient	Variable

0.0264	2.237088	6.317176	1.201418	LNGDP
0.0107	0.658977	0.045905	0.830250	LNPCGDP
0.0250	-2.258111	0.274100	-0.618948	LNTCost
0.0234	2.777088	3.763176	2.120438	LN(GDPit-GDPjt)
0.0000	-6.015724	10628.85	-63940.21	C

Effects Specification		
Rho	S.D.	
0.3292	2104.184	Cross-section random
0.6708	3003.825	Idiosyncratic random

Weighted Statistics			
1086.448	Mean dependent var	0.881213	R-squared
3454.147	S.D. dependent var	0.860845	Adjusted R-squared
2.01E+09	Sum squared resid	31.64686	S.E. of regression
1.910083	Durbin-Watson stat	8.897024	F-statistic
		0.000000	Prob(F-statistic)

Unweighted Statistics			
3230.644	Mean dependent var	0.864701	R-squared
2.288978	Durbin-Watson stat	3.55E+09	Sum squared resid

Table (8) Hausman test for the first model

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Prob.	Chi-Sq. d.f.	Chi-Sq. Statistic	Test Summary
0.0600	4	26.134104	Cross-section random

Table (9): Individual effects model, distance and dummy variables

Dependent Variable: EI
Method: Panel EGLS (Cross-section random effects)
Date: 06/03/21 Time: 01:08
Sample: 2004 2019
Periods included: 16
Cross-sections included: 13
Total panel (unbalanced) observations: 204
Swamy and Arora estimator of component variances

Prob.	t-Statistic	Std. Error	Coefficient	Variable
0.0475	2.296004	1.291692	1.823462	BORDER
0.0223	2.097716	1.261633	0.232820	J-LOAS
0.0331	0.579204	8.246228	0.776245	J-IBA
0.0135	0.505919	730.6864	0.696684	DUCOM
0.0441	-0.196950	0.132983	-0.026191	DIS
0.0430	0.315095	1048.883	330.4973	C

Effects Specification		
Rho	S.D.	
0.9055	1146.051	Cross-section random
0.0945	370.1803	Idiosyncratic random

Weighted Statistics

-0.209511	Mean dependent var	0.751979	R-squared
364.9864	S.D. dependent var	0.743224	Adjusted R-squared
26989157	Sum squared resid	369.2003	S.E. of regression
2.007807	Durbin-Watson stat	0.078509	F-statistic
		0.035463	Prob(F-statistic)

Unweighted Statistics			
-			
6.459250	Mean dependent var	0.835387	R-squared
0.048458	Durbin-Watson stat	1.71E+08	Sum squared resid

Table (10) The individual impact of the trading partner's trade with Iraq

Effect	ID		
-0.935371		BR	1
-1.637297		US	2
2.336485		CN	3
-2.558587		FR	4
-3.747972		CA	5
-2.107168		IT	6
2.550644		IN	7
0.058238		KR	8
-2.919816		JP	9
2.117671		TR	10
2.370540		IR	11
2.673675		JO	12
2.396348		SY	13

Table (11) homogeneity test for the first model

Panel Cross-section Heteroskedasticity LR Test
Null hypothesis: Residuals are homoscedastic
Equation: UNTITLED
Specification: IMP LNGDP LNPOP PC TC DUCOM DUEH DUNIG C

Probability	Df	Value	
0.0000	13	388.7063	Likelihood ratio

LR test summary:

Df	Value	
198	-1871.959	Restricted LogL
198	-1677.606	Unrestricted LogL

Table (12) RFE test with residual fixed effect method

Redundant Fixed Effects Tests
Equation: Untitled
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	10.720344	(12,190)	0.0000
Cross-section Chi-square	107.029519	12	0.0000

Source: results of the statistical program eviews.10

1.Statistical description of the tablet data

Table (1) shows a statistical description of the variables of the first model with respect to the highest and lowest value, the mean, the median, the standard deviation and the probability that was zero for all the variables of the model, with a total number of observations of (208) observations.

2.Unit Root Tests for Panel Data

Table (2), (3), (4) and (5) show the results of unit root tests for the variables of the first model. There are many tests that can be applied to the tablet data. We use there Levin, in & Chu, Pesaran and Shin W-stat tests, ADF-Fisher Chi-square and PP-Fisher Chi-square The results indicate the stability of X-series data, GDP, PCGDPI-PCGDP J, first-difference Tcost and PCGDP-level data.

3.Estimation and testing of the model

The above equation model 8 was estimated taking all variables except distance and dummy variables for 208 observations. The variables - GNP per capita, economic distance - were found to be non-significant. Also, the changing trade-to-GDP ratio is not very strong. Another estimate was taken to replace the demographic variable rather than the per capita GNP. The difference between the per capita GDP variable was also dropped from the estimate. The trade variable has decreased based on GNP, population, trade-to-GDP ratio and the difference in GDP per capita. It covers all 13 countries and the number of observations is 208. All variables, except for population, were found to be significant. So by dropping the population variable from the model, another estimate was taken. This time, all the explanatory variables - GDP, economic cost and the difference in GDP per capita - were found to be significant with the predicted signs.

Based on the foregoing, the estimated model chosen for Iraq's international trade is:

$$Xijt = \alpha 0 ++ \alpha 1 \log (GDPjIt)\ \alpha 2 \log (GDPit * GDPjt) + \alpha 4 (Tcostijt) + \alpha 5 \log(PCGDP) \ldots. (12)$$

The fixed, combined, and random effects test, the Breusch Pagan test, and the Hausman test, which are used to discover the appropriate model from the two fixed and random effects models Table (6). Based on the above test, the fixed effects model is better than the pooled regression model, we can reject the null hypothesis for that, the fixed effects model is more suitable than the pooled model. Moreover, the Breusch Pagan test indicates that we can reject the null hypothesis that there are no random effects, the random effect model is more appropriate than the pooled model. Finally, the research implemented

Hausman's test to compare the estimates of the fixed and random effects model (Table 8), and based on this test, the random effects model is a more suitable model (Table (7), and Table (9) shows the individual effects as the dependent variable and the distance and dummy variables as independent variables. It is clear from Table (6), (11) and (12) that the model is free from the problem of heterogeneity, sequential autocorrelation, normal distribution of model residuals, and stability of model parameters.

Conclusions

1.The commodity structure of Iraqi exports, that oil exports constitute, in each year of the study period, a large proportion of the commodity structure of Iraqi exports compared to the total exports of Iraq, .while the remaining part remains below the level

2.The rise in Iraqi exports from year to year during the study period as a result of the rise in oil prices .in international markets, which calls for the openness of the Iraqi economy with its trading partners

3.It was proven in the international trade model of Iraq that the GDP coefficient is positive and highly significant, as expected, with a probability of less than 0.05. This means that Iraq tends to trade more with larger economies

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