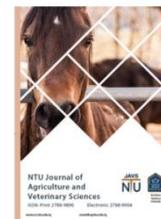




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Econometric and economic analysis of the factors affecting the flow of Iraqi agricultural imports for the period (2004-2022) using the gravity model

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ABSTRACT

The research aims to identify and estimate the most important factors affecting Iraqi agricultural imports from the most important trading partners of Iraq using the gravity model. The time period (2004-2022) was taken with a group of fixed trading partners during this period, collected in the form of (Panel Data) and the research sample amounted to (152). The value of agricultural imports from Iraq's trading partners was taken as a dependent variable, while the independent variables are (the variable of the value of the gross domestic product of Iraq and trading partners, the variable of the geographical distance between the capital of Iraq and the capital of the trading partners, the variable of the population of Iraq and trading partners, the variable of the added value of agricultural production of Iraq and trading partners, the variable of the common borders between Iraq and trading partners, and the variable of the common language between Iraq and trading partners). The estimation was done using the three (Panel Data) estimation methods, and it was found that economic variables such as the gross domestic product reflect the high economic and productive capacity that enables importing and exporting countries alike to improve their ability to enhance the ability to export and import agricultural goods, which leads to an increase in the volume of Iraqi agricultural imports from trading partners. Geographical factors such as the distance between Iraq and its trading partners reflect the negative impact on the volume of agricultural imports between Iraq and its trading partners. The research recommended improving the transportation infrastructure within Iraq and between trading partners by developing ports and expanding the capacity of shipping, especially with countries such as the UAE and improving the road network to facilitate the movement of agricultural goods from the markets of neighboring countries such as (Turkey, Iran, Syria and Jordan).



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Introduction

Foreign trade is one of the important and main pillars of the national economy, as exports, which represent a part of it, are a basic pillar in providing external monetary sources and thus increasing the rate of economic growth. As for agricultural imports, they play a role no less important than exports, especially in developing countries, as they work to alleviate the severity of the food deficit and increase the rate of security from it. Since Iraq suffers from a decrease in the supply of food and needs to provide their requirements and food needs from imported agricultural products that Iraq cannot produce due to the lack of a suitable environment or the high cost of producing them [1], however, foreign trade of agricultural commodities in the past suffered from some shortcomings in its performance to influence the Iraqi economy in terms of important quantity and quality. The reason for this shortcoming is due to some restrictions imposed by the global system on Iraq, as well as the accession of countries to international trade organizations that limit dealing with other countries, including Iraq, except under harsh conditions. This process led to the distortion of Iraq's commercial activity between countries due to several economic, political and cultural factors. Therefore, it was necessary to study some of these factors to know their impact on Iraq's agricultural imports from trading partners using the gravity model to determine the important markets that Iraq deals with in the field of imports of agricultural products and to put Recommendations on which the Iraqi trade policy of agricultural products is based, and studying the geographical distribution of agricultural imports to Iraq from trading partners is no less important than studying the factors that affect them because it shows the extent of the national economy's dependence on the economies of other countries [2].

Importance of the research:

The importance of the research lies in the great importance of agricultural imports between Iraq and the most important trading partners (Egypt, Syria, Jordan, Lebanon, the Emirates, Morocco, Turkey and Iran) in agricultural imports and the large share that these countries return from the geographical distribution of trade exchanges with Iraq and the provision of necessary goods, especially food, to achieve an acceptable level of food security.

Research problem:

The problem revolves around the randomness of Iraqi agricultural imports and the general orientation not on identifying specific trading

partners and not the necessary proportion of them and the flooding with agricultural products even those that Iraq is distinguished by producing locally and can be self-sufficient in, and all this invites us to a number of questions, the most important of which are: What are the most important variables affecting Iraq's agricultural imports from trading partners during the period (2004-2022)? How can it be predicted in the future? What are the policies required to confront and strengthen agricultural trade with trading partners?

Research objectives

- 1- Identifying the most important markets from which Iraq imports its agricultural and food products.
- 2- Identify and estimate the most important variables affecting Iraqi agricultural imports from Iraq's most important trading partners using the gravity model.

MATERIAL AND METHODS:

First: The concept of the gravity model for foreign trade.

The research analysis is based on estimating the factors affecting the value of agricultural imports using the Trade Gravity Model, as it is a model based on a strong theoretical basis that is consistent with modern studies that seek to explain the establishment and flow of trade. This model also takes the independent variables of the country of origin and the variables of the trading partners, thus taking a sufficient number of variables that explain the value of agricultural imports from the trading partners. The time series data will be used. The idea of the Gravity Model goes back to Newton's Law of Universal Gravitation in physics, which is a physical law adopted by the British physicist Isaac Newton in 1687 through numerous astronomical observations, and with the help of Kepler's laws of planetary motion. Gravity is defined as the tendency of two bodies to attract and move towards each other. The law of universal gravitation states that the force of attraction or attraction between two material bodies (M_j , M_i) is directly proportional to the product of their masses, and inversely with the square of the distance separating them and the general formula for Newton's law of universal gravitation was represented in the following equation [3]:

$$F_{ij} = G \times \frac{M_i M_j}{D^2_{ij}}$$

Where F_{ij} represents: the gravitational force between the two bodies M_{ij} represents the product of the masses of the two bodies, while D_{ij} is: the distance between the two bodies and G is: the constant of the equation.

The idea of the gravity model was taken to estimate (foreign trade flows, foreign investment, capital flows and international migration). The first to apply Newton's law in foreign trade was the economist Tinbergen in (1962), who developed and applied a dynamic model stating that the flow of commodity trade between countries around the world is due to the economic power (the mass of the economic system of countries) expressed by the gross domestic product of each country and the geographical distance between these countries as an indicator of the cost of transporting goods. The inclusion of distance is due to the fact that it can be considered that the costs of transport and transactions increase with their size. This was derived from the Newtonian physics relationship that explains the law of gravity, and thus the gravity model in foreign trade in its general cases represented a standard economic function that links or explains the flow of goods between two countries in direct proportion to their masses, i.e. their national income (GDP), and inversely with the transportation costs imposed by the geographical distance between the two countries. Thus, the gravity model became widely used in international trade to explain trade flows between countries [4]. The Tinbergen model takes the following equation [5]:

$$T_{ij} = G \times \frac{GDP_i^{B1} GDP_j^{B2}}{DIST_{ij}^{B3}}$$

The variable (T_{ij}) represents the volume of trade between the two countries (ij), which is the product of the two countries' GDP GDP_j, GDP_i and ($DIST_{ij}$) expresses the distance between the two countries, and (G) is the general equation constant, which means that the volume of trade between two countries is directly proportional to the product of their economic strength, and inversely proportional to the geographical distance between them. The above equation can be converted to the exponential equation in the regression coefficients as follows:

$$T_{ij} = \beta_0 GDP_i^{B1} GDP_j^{B2} Dist_{ij}^{-\beta_3}$$

By taking the logarithm of both sides, the equation is transformed into a linear formula known as the double logarithmic formula and adding the error bound as shown in the equation below:

$$\ln T_{ij} = \ln[\beta_0 + \beta_1 \ln GDP_i + \beta_2 \ln GDP_j - \beta_3 \ln Dist_{ij}] + e_{ij}$$

The basic gravity model equation becomes:

$$\ln T_{ij} = \beta_0 + \beta_1 \ln GDP_i + \beta_2 \ln GDP_j - \beta_3 \ln Dist_{ij} + e_{ij}$$

Since: $\beta_0 = \ln \beta_0$ and e_{ij} : the random error bound of the regression equation above.

Based on the previous equation, it becomes clear that the dependent variable represented by the logarithm of trade exchange, whether (exports or imports) or the total trade between two countries, is explained in terms of three independent or explanatory variables represented by the logarithm of the size of the economy of the first country, the logarithm of the size of the economy of the second country, and the logarithm of the distance separating these two countries. The constants ($\beta_3, \beta_2, \beta_1$) that represent the parameters of the model are considered a measure of the flexibility of trade exchange to explain the level of the size of the economy of the first country, the size of the economy of the second country, and the distance between the two countries.

The results of applied studies using gravity models indicate that the basic variables explain a small part of the changes in foreign trade flows [6]. Therefore, many users of these models in applied studies have worked to expand the determinants of trade flows by adding and including many additional variables that affect trade flows between countries and regions. In 1966, the economist Linneman applied the gravity model to bilateral foreign trade flows, adding the population variable to other variables that encourage foreign trade, represented mainly by the size of the exporting country's GDP and the size of the importing country's GDP. In 1993, the researcher Frankel added dummy variables to the model, such as the two countries sharing borders, language, and history, which are factors that affect the total flows between countries [7].

Second: The concept of cross-sectional time series data (Panel Data).

It is also called panel data or longitudinal data. It provides data for a variable or a group of variables for several sections such as (individuals, companies or countries) during different points in time. Thus, it monitors changes between several sections such as (individuals, companies or countries) and can measure the dynamic changes of that variable over time. Thus, it takes the (sections) dimension from the characteristics of the cross-section (Cross-Sectional) and the (time dimension) from the characteristics of the time series (Time Series). The use of panel or longitudinal data packages (Panel Data) includes special estimation models, new standard methods and new methods for processing its data [8].

1. Basic estimation models for cross-sectional time series data (Panel Data).

Cross-sectional time series models (Panel Data) can be derived through the regression model called the following unobserved effects model [9]:

$$Y_{it} = \beta X_{it} + Z_i\alpha + \mu_{it}$$

Since there are (K) variables represented by (X_{it}) and (β) is the coefficient of the independent variable that affects the dependent variable (Y_{it}) Where (ε_{it}) is the random error term and (Z_iα) is the non-variance or individual effects, where (Z_i) contains the unobserved factors that affect the dependent variable and cannot be measured, such as skills and preferences, which are constant over time and change across individuals. From this model, the following three basic (Panel Data) models can be derived:

A- Pooled Regression Model.

The simplest model in the regression of cross-sectional time series data (Panel Data) is the pooled regression, as through the previous model when the tendencies and constants are homogeneous, i.e. there is no difference between individuals (there are no unobserved factors that differ between individuals) and thus (0= Z_i) and only the fixed term remains (i.e. there are no effects specific to individuals) and on this basis the model is treated as a classic integrated model that takes the following formula [10]:

$$Y_{it} = \alpha + \beta X_{it} + \epsilon_{it}$$

(α and β) can be estimated by performing ordinary least squares (OLS) which provides consistent and

efficient estimates of both the constant (α) and the regression coefficients (β). In the context of panel data, the data set (β_Pool) is called the pooled ordinary least squares (PLS) regression model which can be solved as follows:

$$\begin{aligned} \beta_{Pool} &= \left(\sum_{i=1}^N \sum_{tSi}^N X_{it} \dot{X}_{it} \right)^{-1} \left(\sum_{i=1}^N \sum_{tSi}^N X_{it} Y_{it} \right) \\ &= \left(\sum_{i=1}^N X_i \dot{X}_i \right)^{-1} \left(\sum_{i=1}^N \dot{X}_i Y_i \right) \\ &= (\dot{X}X)^{-1}(\dot{X}Y) \end{aligned}$$

The residual vector for individual _i is:

$$e_i = Y_i - \dot{X}_i\beta_{Pool}$$

B- Fixed Effects Model:

The second model used in estimating panel data is the Fixed Effects Model. According to the previous individual effects model, unobserved factors are found in part (Z_i) and are associated with the independent variables and change across individuals but do not change across time. They are included with the fixed term and the fixed effects model is as follows [9]:

$$Y_{it} = \beta X_{it} + \alpha_i + \mu_{it}$$

Where (Y_{it}) is the dependent variable for individuals (i) at time (t) and (X_{it}) it is the independent variable, while (β) is the parameter of the independent variable and α_i are the unobserved factors that vary across individuals and are constant over time, and (ε_{it}) is the random error term and (α_i = Z_iα) represents all unmeasured effects and defines an estimable conditional mean. This fixed effects approach takes (α_i) to be a fixed term specific to the group in the regression model. It should be noted that the term "fixed" as used here indicates that the term does not change over time. It is noted that when the unobserved factors included in the fixed term are correlated with the independent variable (X_{it}), the least squares estimator of β) is biased and inconsistent, so the fixed effect must be estimated using dummy variables (Least Squares Dummy Variable). This method is one of the famous methods for estimating the fixed effects model in the analysis of cross-sectional time series data (Panel Data) by

adding dummy variables to represent each unit in the sample. These dummy variables capture the effects of each unit in the model, i.e. the (LSDV) method shows that the clear generalization of the fixed intercept model for cross-sectional time series data (Panel Data) is done by introducing dummy variables to take into account the effect of unobserved and omitted variables that are specific to individual cross-sectional units. To facilitate highlighting the difference between the specifications of unobserved variables in this method, we assume that there are no time-specific effects and focus only on individual-specific effects [10]. The fixed effect estimator (FE) can be calculated by summing all observations for all cross-sectional units and then adding Dummy variables for each unit in the overall regression when summing the regressions in (N) as in the following formula [11]:

$$Y = \sum_{i=1}^N \alpha_i D_i + X\beta + \mu_i$$

Since (D_i) is a vector of size ($NT \times 1$) of a dummy variable whose elements are all zero except for the elements associated with the cross-sectional unit (i) which are set to one, it is easy to notice that the ordinary least squares estimator (β) in this regression is the same as the fixed effect estimator (FE). For this reason, the fixed effect estimator is also known as the least squares dummy variables (LSDV) estimator. However, when (N) is relatively large, this method is not computationally efficient compared to using the combined formula mentioned in other methods. Extreme caution should be exercised when using the (LSDV) method, as the standard errors obtained from such regressions are valid only under the strong assumptions that the errors are homogeneous and uncorrelated in time [12]. The advantages of this method are that it estimates the individual fixed effects directly, allows the inclusion of time-invariant variables, and provides a direct interpretation of the fixed effects. Its disadvantages are that it is not suitable for use when the intercepts (N) are large as mentioned above, and it leads to the loss of degrees of freedom. The model may suffer from the problem of cross-parameters when the number of time periods (T) is small.

C- Random Effect Model.

The third model used to estimate the panel data that can be derived from the individual effects model is

the random effects model, through which the unobserved factors (α_i) are associated with the random error term instead of being associated with the fixed term in the previous fixed effects model. The basic condition for the random effects model is that the unobserved factors (α_i) are not associated with the independent variable (X_{it}) because they are associated with the random error term. One of the most important reasons for resorting to a random effects model is that in the case of a very large number of parameters in the fixed effects model and the loss of degrees of freedom can be avoided, it is assumed that the unobserved factors (α_i) are random. This model is suitable for representation in the case that individuals (N) are taken from a large community because the number of parameters is very large if we use the fixed effect model, so we resort to the random effects model, and this model can be written in the following formula [12]:

$$Y_{it} = \alpha + \beta X_{it} + \mu_{it}$$

The previous equation contains (μ_{it}) which shows the association of unobserved factors (μ_i) with the random error term (v_{it}) to form the following random effect model or what is called the compound error (error component):

$$\mu_{it} = \mu_i + v_{it}$$

Where (μ_{it}) refers to the compound error model, (μ_i) to the unobserved effect, and (v_{it}) refers to the random error term when:

$$\mu_i \sim N(0, \sigma_\mu^2)$$

$$v_{it} \sim N(0, \sigma_\varepsilon^2)$$

The independent variables are constant over time and the individual (random) effects are independent. Since the random error is a compound containing two parts, the first part is the unobserved factors (μ_i) and the second part is the random error (v_{it}). The unobserved factors may be different from one individual to another, and thus the variance is not constant. Therefore, in anticipation of the problem of heterogeneity of variance, the generalized least squares (GLS) method is used to estimate the random effect instead of the regular least squares method, as follows [11]:

Let $v_i = (v_{i1}, v_{i2}, \dots, v_{iT})$ and when $v_{it} = \alpha_i + \mu_{it}$ Based on this assumption, the variance-covariance matrix is:

$$E(v_{it}^2) = \sigma_\alpha^2 + \sigma^2 + 2Cov(\alpha_i, \mu_{it}) = \sigma_\alpha^2 + \sigma^2$$

And

$$E(v_{it}v_{is}) = E[(\alpha_i + \mu_{it})(\alpha_i + \mu_{is})] = \sigma_\alpha^2 \text{ for } t \neq s$$

By solving, we get the following matrix:

$$\sum v = E(v_i v_i') = (\sigma_\alpha^2 + \sigma^2) \begin{bmatrix} 1 & \rho & \dots & \rho \\ \rho & 1 & \dots & \rho \\ \vdots & \vdots & \ddots & \vdots \\ \rho & \rho & \dots & 1 \end{bmatrix}$$

And that:

$$\rho = \frac{\sigma_\alpha^2}{\sigma_\alpha^2 + \sigma^2}$$

(ρ) is the ratio of the variance of individuals to the total variance and is limited between (0,1) and the closer it is to (0), the more the random effect approaches the (Pooled) model and the closer it is to (1), the more the random effect model approaches the fixed effect (Fixed Effects Model) and between them it is considered a random effect and when the variance of individuals for unobserved factors (σ_α^2) is equal to zero then (ρ) and this means that there are no differences between individuals, and by using the generalized least squares method (GLS) it is possible to obtain an effective estimator (β) which is given by the following equation:

$$\widehat{\beta}_{RE} = \left(\sum_{i=1}^N \hat{X}_i \sum_v^{-1} X_i \right)^{-1} \sum_{i=1}^N \hat{X}_i \sum_v^{-1} Y_i$$

Assuming that ($\widehat{\beta}_{RE}$) is consistent with (β) when ($\infty \rightarrow N, T$) under these assumptions, it is also effective with the variance:

$$Var(\widehat{\beta}_{RE}) = \left(\sum_{i=1}^N \hat{X}_i \sum_v^{-1} X_i \right)^{-1}$$

The random effects approach is considered more general and comprehensive than the fixed effect, as it believes that each country or each year differs in its random limit, so that the fixed effect is considered as a special case (Within-Units) within the random effect, because the error components model combines the variation within each unit across time periods, in addition to the variation between the units (Between-Units).

2 -Tests of trade-off between basic models for cross-sectional time series data (Panel Data):

A- Fisher's statistic test:

Fisher's test is based on the trade-off between the pooled regression model and the fixed effects model in cross-sectional time series data (Panel Data) by testing the fixed effects in the unrestricted model that estimates the dummy variables that represent the unobserved factors and the null hypothesis is ($H_0: \mu_1 = \mu_2 = \dots = \mu_{N-1} = 0$) as by estimating the value of (F) the sum of the restricted residual squares (RRSS) is the sum of the ordinary least squares in the pooled regression model and the sum of the unrestricted residual squares (URSS) is the sum of the residual squares in the fixed effects regression using the (LSDV) method. However, if N is large, a transformation is performed (Within) and this sum of the residual squares is used as the sum of the URSS squares and the value is calculated the statistic (F) is calculated according to the following formula [13]:

$$F = \frac{(RRSS - URSS)/N - 1}{URSS/(NT - N - K)} \sim {}^{HO}F_{N-1, N(T-1)-K}$$

Since: K = number of estimated parameters, N = number of individuals, and the two basic hypotheses for this test can be formulated as follows:

1- Alternative hypothesis (H1): indicates the presence of unobserved factors represented by dummy variables in the fixed effects model, and then the calculated (F) value is greater than the tabular (F) value at a statistical level of (5%), and thus the fixed effects model is the best.

2- Null hypothesis (H0): indicates that the parameters of unobserved factors are equal to zero, and then the calculated (F) value is less than the tabular (F) value at a statistical level of (5%), and thus the cumulative regression model is the best.

B- Lagrange multiplier test.

It is one of the tests used in comparing the pooled regression model and the random effects model in panel data. Breusch and Pagan (1980) designed a Lagrange multiplier test to detect the

presence of random effects in the random effects model based on ordinary least squares (OLS) residuals. The statistical value of the LM test is calculated according to the following formula [9]:

$$LM = \frac{NT}{2(T-1)} \left[\frac{\sum_{i=1}^N [\sum_{t=1}^T e_{it}]^2}{\sum_{i=1}^N \sum_{t=1}^T e_{it}^2} - 1 \right]^2$$

$$= \frac{NT}{2(T-1)} \left[\frac{\sum_{i=1}^N (T\bar{e}_i)^2}{\sum_{i=1}^N \sum_{t=1}^T e_{it}^2} - 1 \right]^2$$

The two basic hypotheses for this test are:

1. Alternative hypothesis (H1): indicates that there are significant random effects in the cross-sectional data ($H_1: \sigma_{it}^2 \neq 0$), and that the random effects model is better than the pooled regression model.

2. Null hypothesis (Ho): indicates that the error variance components of the time-specific effects or individual-specific effects in the random effects model are zero ($H_0: \sigma_{it}^2 = 0$), i.e. the pooled regression model is better than the random effects model. According to the null hypothesis, the LM is distributed as a chi-square with one degree of freedom.

T-Hausman test:

It is one of the tests used to compare between the fixed effects model and the random effects model. It was presented by the scientist (Hausman) in (1978). He presented an approach through which he gives a comparison between two models, one of which gives consistent results and achieves efficiency under the null hypothesis (H0) and the other is consistent but ineffective at the same time under the alternative hypothesis (H1). The first model should give inconsistent results and the second is consistent. This can be applied to compare between the fixed effects model and the random effects model, as the random effects model gives the best unbiased linear estimates, i.e. it is consistent, unbiased and achieves efficiency. However, if there is a correlation between the random error term and the independent variables in the random effects model, its estimates will be inconsistent and therefore the fixed effects model will be preferred over the random effects model. Unobserved factors may be associated with the independent variables in the random effects model, if there are omitted variables, for which the fixed effects model is strong, as the effects model estimates are The fixed effects are always consistent, but they do not always achieve efficiency compared to the estimates of the random effects model. The hypotheses for the fixed effects and random effects models can be explained as follows [13]:

1. Hypothesis (H0): The appropriate model is the random effects, there is no correlation between the random error term and the independent variables in the estimated cross-sectional time series data model, i.e. the random effects model is characterized by consistency and efficiency $Cov(\alpha_i, X_{it}) = 0$

2. Hypothesis (H1): The appropriate model is the fixed effects, the correlation between the error term and the independent variables in the panel data model is statistically significant, i.e. it is characterized by consistency only $Cov(\alpha_i, X_{it}) \neq 0$

The mathematical formula for the (Hausman) test is

$$H = (\hat{\beta}^{RE} - \hat{\beta}^{FE}) [Var(\hat{\beta}^{RE}) - Var(\hat{\beta}^{FE})]^{-1} (\hat{\beta}^{RE} - \hat{\beta}^{FE})$$

Where:

$(\hat{\beta}^{RE} - \hat{\beta}^{FE})$ = is the difference between the estimators of the random effects and the fixed effects.

As for $Var(\hat{\beta}^{RE}) - Var(\hat{\beta}^{FE})$ = is the difference between the covariance matrix of each of the estimators of the random effects and the fixed effects.

Third: Description of the standard model for factors affecting the value of agricultural imports from trading partners.

Due to the specificity of the gravity model, which includes many independent economic, non-economic and dummy variables, and the use of cross-sectional time series data models (Panel Data), it is necessary to rely on the statistical program (Stata17) because of its accurate capabilities that are consistent with the nature of this type of data, variables and models. Before starting to estimate the standard model, the study sample community must be explained in detail. The study sample includes (8 countries) that are fixed trading partners throughout the study period in terms of agricultural imports. Although we followed the bulletins of the Ministry of Planning / Directorate of Foreign Trade Statistics, we did not see fixed partners throughout the study period other than these countries (Egypt, Syria, Jordan, Lebanon, Emirates, Morocco, Iran, Turkey). Data on the value of agricultural imports with these countries were collected for the period (2004-

2022). Accordingly, the total study data results from multiplying the series (T=19) by the number of sections (N=8). The number of observations (152) observations becomes the total number of observations for the study. The trading partners were arranged in the cross-sectional time series data as follows (Egypt (1), Syria (2), Jordan (3), Lebanon (4), UAE (5), Morocco (6), Turkey (7), Iran (8)) for the period (2004 - 2022) and by identifying and measuring the reflections of the factors affecting agricultural imports to Iraq from trading partners and since we use the gravity model in our study, it is necessary to add the logarithm (Ln) to the dependent variable and the independent variables to convert the gravity equation from exponential to linear and our study will rely on the following standard model:

$$\begin{aligned} \text{LnImpij} = & \beta_0 + \beta_1 \text{LnGDPi} + \beta_2 \text{LnGDPj} \\ & + \beta_3 \text{LnDistij} + \beta_4 \text{LnPOPi} \\ & + \beta_5 \text{LnPOPj} + \beta_6 \text{LnAGRi} \\ & + \beta_7 \text{LnAGRj} + \beta_8 \text{contig(D1)} \\ & + \beta_9 \text{Comlang(D2)} + ei \end{aligned}$$

So:

Ln = logarithmic formula.

Impij = Variable value of agricultural imports from trading partners to Iraq, which reflects the volume of monetary trade flows from (country j) which represents the trading partner to (Iraq (i) during the study period (dollars).

GDPi = Variable size of the economy (value of gross domestic product) expressed in the total monetary value of goods and services produced (for Iraq i) during the study period (dollars).

GDPj = Variable size of the economy (gross domestic product) expressed in the total monetary value of goods and services produced for trading partners (country j) during the study period (dollars).

Distij = Variable geographical distance between the capital of (country (i) and the capital of trading partners (country j) (km).

POPi = Variable population of Iraq (i) during the study period (people).

POPj = Variable population of trading partners (j) during the study period (people).

AGRi = Variable value of agricultural output added to the GDP of Iraq (country i) during the study period (dollars).

AGRj = Variable value of agricultural output added to the GDP (country j) during the study period (dollars).

contig(D1)= A dummy variable that reflects the common borders between Iraq (country i) and trading partners (country j) and takes the value (1) if there is a common border and the value (0) otherwise.

Comlang(D2)) = A dummy variable that reflects the common language between (Iraq (i) and trading partners (country j) and takes the value (1) if there is a common language and the value (0) otherwise.

RESULTS AND DISSCUSION

First: Testing descriptive statistics indicators for study variables during the period (2004-2022).

Table (1) shows that the variable of agricultural imports value (LnImpij) reached a general average across all units of about (16.435), and ranges between a maximum of (22.767) and a minimum of (6.579), while the general standard deviation reached (2.883), which means that the data has a medium variance between the values. As for the variables of the value of Iraq's gross domestic product (LnGDPi) and the value of the gross domestic product of trading partners (LnGDPj), we note from Table (1) that the general average of the variable (LnGDPi) across all units reached (25.686), and ranges between a maximum of (26.03) and a minimum of (25.25), while the general standard deviation reached (0.27), while the variable of the value of the gross domestic product of trading partners (LnGDPj) reached a general average across all units of (25.616), and ranges between a maximum of (27.809) and a minimum of (23.451) while the general standard deviation was (1.267). As for the variable of geographical distance between Iraq and trading partners (LnDistij), its general average was (7.104), and it ranged between a maximum of (8.455) and a minimum of (6.54), while the general standard deviation was (0.592). As for the variables of the population of Iraq (LnPOPi) and the population of trading partners (LnPOPj), we note that the general average of the variable (LnPOPi) across all units was (17.352), and it ranged between a maximum of (17.559) and a minimum of (17.116), while the general standard deviation was (0.127). As for the variable of the population of trading partners (LnPOPj), its general average across all units was (25.616), and it ranged between a maximum of (27.809) and a minimum of (23.451) The general standard deviation was (1.267), as for the variables added value of agricultural output to the GDP of Iraq (LnAGRi) and the variable added value of

agricultural output to the GDP of trading partners (LnAGRj), we note from Table (23) that for the variable (LnAGRi), the general average was (22.942), and ranged between a maximum of (23.392) and a minimum of (22.4904), while the general standard deviation was (0.231), as for the variable added value of agricultural output to the GDP of trading partners (LnAGRj), we note that the general average was (22.929), and ranged between a maximum of (24.937) and a minimum of (20.538), while the general standard deviation was (1.366), as for the dummy variable common borders between Iraq and trading partners (contig(D1)) The general average for it was (0.5) which is a variable that contains only two values, which are (1) and (0). As for the second dummy variable, the common borders between Iraq and the trading partners (comlang(D2)), the general average for it was (0.75) which is a variable that contains only two values (1) and (0). As for the variance between the units (Between) of this variable, we find that its standard deviation was (0.463) and the maximum was (1) and the minimum was (0). As for the analysis over time (Within) of this variable, we find that its standard deviation was (0) because it is a variable that does not change over time.

Second: Standard and economic analysis of the variables affecting the value of agricultural imports with Iraq's trading partners during the period (2004-2022).

We will conduct the standard and economic analysis of the variables affecting the value of agricultural imports from Iraq's trading partners during the period (2004-2022) by estimating the static time series models (Panel Data) and then we conduct trade-off tests between the estimated basic models and choose the appropriate model and use standard problem tests to detect whether the estimated model suffers from problems or not and then we use correction methods that suit these problems as follows:

1 -Estimating the basic data models (Panel Data) for the variables affecting the value of agricultural imports from Iraq's trading partners during the period (2004-2022).

Table (2) shows the results of estimating the variables affecting the value of agricultural imports from Iraq's trading partners during the period (2004-2022) using the three basic static time series models (Panel Data). The first model is the pooled

regression model, the second model is the fixed effects model, and the third model is the random effects model.

2- Comparison tests between the basic estimation models for the Panel Data for the model of the value of agricultural imports from Iraq's trading partners during the period (2004-2022).

In order to choose the appropriate model, we conducted the trade-off tests as in Table (3) after estimating the three basic time series data models (Panel Data) for the model of the value of agricultural imports from Iraq's trading partners during the period (2004-2022). Table (3) shows that the value of (F) for the (Fashair) test reached (0.63) at a significance level of (0.639), which is greater than (5%). Accordingly, we accept the null hypothesis (H0), which assumes that there are no fixed effects of unobserved factors in the model of the value of agricultural imports from trading partners, i.e. the pooled regression model (Regression Model Pooled) is the best, and we reject the alternative hypothesis (H1), which states that there are fixed effects of unobserved factors in the model of the value of agricultural imports from trading partners. Table (3) shows that the value of the Hausman test for the model of the value of agricultural imports from trading partners reached (2.54) at a significance level of (0.980) which is greater than (5%), and therefore we accept the null hypothesis (H0) which states that the random effects model (Random Effect Model) is the best, and we reject the alternative hypothesis which states that the fixed effects model (Fixed Effects Model) is the best. It is clear from Table (3) that the value of the Breusch and Pagan test for the model of the value of agricultural imports from trading partners reached (1.98) at a significance level of (0.0797) which is greater than (5%), and therefore we accept the null hypothesis (Ho) which states that the regression model (Regression Model Pooled) is the best, and we reject the alternative hypothesis (H1) which states that the random effects model (Random Effect Model) is the best, through the comparison tests between the cross-sectional time series data models (Panel Data) estimated for the previous 6 model of the value of agricultural imports, we conclude that the regression model (Regression Model Pooled) is the best. Among the basic estimated models, before the economic interpretation of this model, it is necessary to examine whether the model suffers

from standard problems through the following tests:

3- Tests to detect standard problems for the basic estimation models of the Panel Data for the model of the value of agricultural imports from Iraq's trading partners during the period (2004-2022).

After conducting the standard estimation of the basic models of the Panel Data for the agricultural import value model, we will evaluate the study models to know the efficiency of the models in terms of their freedom from standard problems, including the selected model, the Regression Model Pooled, through diagnostic tests. Table (4) shows the results of the tests to detect the problem of heterogeneity of variance in the gravity model for the value of agricultural imports, and the Breusch – Pagan / Cook-Weisberg test is used to detect the problem of heterogeneity of variance in the regression model pooled if the value of this test reaches (3.88) at a significance level of (0.049) which is less than (5%), and from it we can reject the null hypothesis (H0) stating that there is no problem of heterogeneity of variance and accept the alternative hypothesis (H1) which states that there is a problem of heterogeneity of variance in the estimated model. Table (4) also shows the results of the tests to detect the problem of autocorrelation in the gravity model for the value of agricultural imports, and the test (Cumby-Huizinga test for autocorrelation) is used to detect the problem of autocorrelation in the pooled regression model. The value of this test reached (30.923) at a significance level of (0.000) which is less than (5%). From this, we can reject the null hypothesis (H0) which states that there is no problem of autocorrelation and accept the alternative hypothesis (H1) which states that there is a problem of autocorrelation in the pooled regression model. Table (4) also shows the results of the tests to detect the problem of misspecification of the gravity model for the value of agricultural imports from trading partners. The (Ramsey RESET Test) was used to detect the problem of misspecification of the model in the pooled regression model if the value of this test reached (0.59) at a significance level of (0.623) which is greater than (5%). Accordingly, we accept the null hypothesis (H0) which states that there is no problem of misspecification of the estimated model and reject the alternative hypothesis (H1) which states that there is a problem of misspecification in the pooled

regression model. Estimated, after examining the estimated models of the gravity model for the value of agricultural imports from standard problems through previous diagnostic tests, it was found that the regression model (Regression Model Pooled) chosen by the previous trade-off tests suffers from the problem of autocorrelation and suffers from the problem of heteroskedasticity and does not suffer from the problem of misspecification of the model (RESET), and accordingly we will follow methods through which we correct the problems suffered by the chosen model and according to each problem and agencies:

4 -Standard estimation and economic interpretation of (Regression Model Pooled) corrected from the standard problems of the model of the value of agricultural imports from Iraq's trading partners during the period (2004-2022) .

After the comparison tests chose the cluster regression model (Regression Model Pooled), it became clear that the model suffers from the problem of heterogeneity of variance and the problem of autocorrelation. On this basis, we introduced (Cluster(id)) to make (std. err) immune to these problems. Accordingly, the gravity model for the value of agricultural imports to Iraq from trading partners in its logarithmic form is as follows:

$$\begin{aligned} \text{LnImp}_{ij} = & -28.285 + 8.187\text{LnGDP}_i \\ & + 2.267\text{LnGDP}_j \\ & - 1.888\text{LnDist}_{ij} \\ & - 13.211\text{LnPOP}_i \\ & - 1.952\text{LnPOP}_j \\ & + 0.686\text{LnAGR}_i \\ & + 1.306\text{LnAGR}_j \\ & + 4.556\text{contig}(D1) \\ & + 5.673\text{Comlang}(D2) \end{aligned}$$

Based on the results obtained from the process of estimating the gravity model for the value of agricultural imports using the pooled regression model that is immune to the problem of autocorrelation and the problem of heterogeneity of variance, we note from Table (5) that the value of the coefficient of determination (R2) reached (0.65), meaning that the variables affecting the value of agricultural imports from trading partners in the gravity model explain about (65%) of the changes in the dependent variable, while (35%) are not explained, i.e. the variables not included in the

gravity model are responsible for it and the value of the random variable is taken, while the value of the calculated (F) test that measures the significance of the function as a whole reached (29.20) with a significance of (0.000) which is less than (5%), which means that the estimated gravity model is significant as a whole, and it is shown from Table (5) that the logarithm parameter of the variable of the value of the gross domestic product of Iraq (LnGDPi) reached (8.187), and the positive sign indicates the existence of a direct relationship between The variable of the value of the gross domestic product of Iraq (LnGDPi) and the value of agricultural imports from trading partners, i.e. increasing the value of the gross domestic product of Iraq by (1%) will lead to an increase in the value of agricultural imports from trading partners by (8.187%), and this is consistent with economic logic and the theory of gravity, and the significance of this variable was proven, as it had a significant effect at the level of (1%). As for the logarithm parameter of the variable of the value of the gross domestic product of Iraq's trading partners (LnGDPj), it reached (2.267), and the positive sign indicates the existence of a direct relationship between the variable of the value of the gross domestic product of trading partners (LnGDPj) and the value of agricultural imports with trading partners, i.e. increasing the value of the gross domestic product of trading partners by (1%) will lead to an increase in the value of agricultural imports from trading partners by (2.267%), and this is consistent with economic logic and the theory of gravity, because increasing the value of the gross domestic product of trading partners will lead to an increase in the size of the economy of trading partners and thus an increase in agricultural production directed for export to Iraq, and it was proven The significance of this variable was significant at the (1%) level. The logarithm parameter of the geographical distance variable between Iraq and its trading partners (LnDistij) reached (1.888-), and the negative sign indicates the existence of an inverse relationship between the geographical distance variable between Iraq and its trading partners (LnDistij) and the value of agricultural imports from trading partners, i.e. increasing the geographical distance between Iraq and its trading partners by (1%) will lead to a decrease in the value of agricultural imports from trading partners by (1.888%). This is consistent with economic logic and the theory of gravity because the greater the geographical distance

between Iraq and its trading partners, the greater the cost of importing goods and products, including agricultural ones, because Iraq imports goods and products based on the CIF price (Cost + Insurance + Freight), which includes the costs of shipping and transporting the goods and insuring them until they arrive in Iraq. Also, agricultural goods and products are susceptible to rapid spoilage, which reduces the value of agricultural imports from the trading partner that is further away in terms of distance compared to the closest trading partner. This is what the theory of gravity stipulated, and the significance of this variable was proven at the level of (1%). As for the logarithm parameter of the number variable, The population of Iraq (LnPOPi) reached (-13.211), and the negative sign indicates the existence of an inverse relationship between the population of Iraq (LnPOPi) and the value of agricultural imports from trading partners, i.e. an increase in the population of Iraq by (1%) will lead to a decrease in the value of agricultural imports from trading partners by (13.211%). This may be due to a change in the pattern of local consumption with the increase in the population, such as the trend towards consuming manufactured goods instead of agricultural goods or searching for goods from countries other than trading partners. This has led to the emergence of the negative impact of the variable of the population of Iraq, and the significance of this variable was proven at the level of (5%). The logarithm parameter of the population variable of Iraq's trading partners (LnPOPj) reached (-1.952), and the negative sign indicates the existence of an inverse relationship between the population of Iraq's trading partners (LnPOPj) and the value of agricultural imports from trading partners, i.e., increasing the population of trading partners by (1%) will lead to a decrease in the value of agricultural imports from trading partners by (1.952%). This is consistent with economic logic because increasing the population of trading partners will lead to an increase in demand for their agricultural products by their population, and thus a decrease in agricultural exports to Iraq and finally a decrease in the value of agricultural imports from trading partners. The significance of this variable was proven at the level of (1%). As for the logarithm parameter of the value added variable of agricultural output to the gross domestic product of Iraq (LnAGRi), it reached (0.686), and the significance of this variable was not proven at the level of (5%). As for the logarithm parameter of the value added variable of agricultural output to the

gross domestic product of Iraq's trading partners (LnAGRj) It reached (1.306), which means that there is a direct relationship between the added value of agricultural output to the gross domestic product of Iraq's trading partners (LnAGRj) and the value of agricultural imports from trading partners, i.e. increasing the added value of agricultural output to the gross domestic product of trading partners by (1%) will lead to an increase in the value of agricultural imports from trading partners by (1.306%), and this matches the economic logic because increasing the value of agricultural output of trading partners will lead to agricultural exports to Iraq, and the significance of this variable was proven at the level of (1%). Between the common language variable between Iraq and its trading partners (Comlang(D2)) and the value of agricultural imports from trading partners, i.e. increasing the common language between Iraq and its trading partners by (1%) will lead to an increase in the value of agricultural imports from trading partners by (5.673%). This is consistent with economic logic and the theory of gravity because countries that have a common language have cultural ties and similar tastes. Given that most of Iraq's trading partners in the field of agricultural foreign trade are Arab countries with which Iraq shares the same language, this led to the emergence of a significant positive relationship for this variable, as it was significant at the level of (1%). This indicates the importance of this variable in the model of the value of agricultural imports with trading partners.

Conclusion:

1- It was found that economic factors such as Iraq's GDP and trading partners play a major role in determining the volume of agricultural imports between Iraq and partner countries, as the increase in GDP reflects the high economic and productive capacity that allows both importing and exporting countries to improve their ability to trade. This means that any increase in Iraq's GDP and trading partners enhances the ability to import agricultural goods.

2- Geographical factors such as the distance between Iraq and its trading partners reflect a negative impact on the volume of agricultural imports between Iraq and its trading partners. The other geographical factor, which represents the common borders, contributes positively to enhancing agricultural imports from trading

partners by facilitating transportation and reducing its costs.

3- The cultural factor, such as the common language between Iraq and the partner countries, is one of the positive factors that contribute significantly to enhancing agricultural imports because it helps reduce barriers and enhances trade effectiveness between Iraq and the partner countries, which leads to increased trade exchange and enhanced economic sustainability.

4- The variable of the population of trading partners has an inverse effect on agricultural imports, indicating that population increase may lead to an increase in local demand for agricultural products and a decrease in imports because the increase in the population in partner countries leads to a decrease in the volume of agricultural imports. Therefore, it can be said that population increase may create pressures on local demand by reducing dependence on foreign trade in favor of meeting local needs.

Recommendations:

1 -Improving import capacity by enhancing local economic growth through adopting incentive policies to increase local productivity and raise GDP, which will help stimulate demand for agricultural imports.

2 -Iraq should improve the transportation infrastructure within Iraq and between trading partners by developing ports and expanding maritime shipping capacity, especially with countries such as the UAE and improving the land road network to facilitate the movement of agricultural goods from neighboring markets such as (Turkey, Iran, Syria and Jordan).

3 -Working to develop a legal and regulatory framework to protect the local agricultural market from dumping. This can be done by applying customs tariffs or imposing fees on imported agricultural products that are sold at prices lower than production costs and establishing a mechanism to determine dumping by tracking the prices of imported agricultural products and comparing production costs in exporting countries to determine whether prices represent dumping. Iraq should also negotiate trade agreements with its trading partners that include protecting its markets against dumping in the agricultural sector. These agreements should be flexible to allow Iraq to protect its local producers from dumping policies.

4- By noting the cultural and linguistic factors that positively affect agricultural trade, Iraq should exploit cultural commonalities with Arab countries and Iran to enhance trade cooperation. This can be done by creating platforms for cultural and economic communication to facilitate trade cooperation.

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Table 1. Testing descriptive statistics indicators for study variables during the period (2004-2022).

Variable		Mean	Std. dev.	Min	Max	Observations
LnImpij	Overall	16.435	2.883	6.579	22.767	N=152
LnGDPI	Overall	25.686	0.27	25.25	26.03	N=152
LnGDPj	Overall	25.616	1.267	23.451	27.809	N=152
LnDistij	Overall	7.104	0.592	6.54	8.455	N=152
LnPOPi	Overall	17.352	0.127	17.116	17.559	N=152
LnPOPj	Overall	17.014	1.099	15.2	18.525	N=152
LnAGRi	Overall	22.942	0.231	22.4904	23.392	N=152
LnAGRj	Overall	22.929	1.366	20.538	24.937	N=152
contig(D1)	Overall	0.5	0.502	0	1	N=152
comlang(D2)	Overall	0.75	0.434	0	1	N=152

Source: Prepared by the researcher based on the outputs of the (Stata17) program.

Table 2. Results of estimating the basic (Panel Data) models for the model of the value of agricultural imports with Iraq's trading partners during the period (2004-2022).

Variables	(Regression Model Pooled)		(Fixed Effects Model)		(Random Effect Model)	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
LnGDPI	8.187	0.000 (***)	8.136	0.000 (***)	8.187	0.000 (***)
LnGDPj	2.267	0.000 (***)	1.629	20.28 (no)	2.267	0.000 (***)
LnDistij	-1.888	0.000 (***)	-2.418	50.02 (**)	-1.888	0.000 (***)
LnPOPi	-13.211	0.001 (***)	-13.877	0.001 (***)	-13.211	0.001 (***)
LnPOPj	-1.952	0.000 (***)	-1.124	70.49 (no)	-1.952	0.000 (***)
LnAGRi	0.686	0.322 (no)	0.640	80.36 (no)	0.686	0.320 (no)
LnAGRj	1.306	0.028 (**)	2.277	70.04 (**)	1.306	0.007 (***)
Contig (D1)	4.556	0.000 (***)	8.194	60.04 (**)	4.556	0.000 (***)
Comlang (D2)	5.673	0.000 (***)	9.033	50.01 (**)	5.673	0.000 (***)
Constant	-28.285	272.0	-35.946	0.211	-28.285	0.270
R-squared	0.65		0.66		0.65	
F-test	29.20	0.000	20.02	0.000	262.82	0.000
Significant	(*)Significant at the 10% ;(**)Significant at the 5% ; (***) Significant at the 1% and (no) Not Significant					

Source: Prepared by the researcher based on the outputs of the (Stata17) program.

Table 3. Comparison tests between the basic estimation models for the (Panel Data) data for the agricultural import value model.

Model comparison tests		
F	63.0 F =	963Prob > F = 0.
hausman fe, re	2.54chi2(9) =	980Prob > chi2 = 0.
Breusch and Pagan Lagrangian multiplier test for random effects	98.1chi2(01) =	797Prob > chi2 =0.0

Source: Prepared by the researcher based on the outputs of the (Stata17) program.

Table 4. Tests to detect standard problems for basic estimation models for (Panel Data) data for the agricultural import value model.

Standard diagnostic tests	Pooled regression model
Heteroskedasti problem	Breusch – Pagan / Cook-Weisberg test for heteroskedasticity: chi2(1) = 3.88 Prob > chi2 = 0.049
Autocorrelation problem	Cumby-Huizinga test for autocorrelation: chi2(1) = 30.923 Prob > chi2 = 0.000
Model misspecification problem (Ramsey RESET)	:Ramsey RESET test for omitted variables F(3, 141) = 0.59 Prob > F = 0.623

Source: Prepared by the researcher based on the outputs of the (Stata17) program.

Table 5. Results of estimating the corrected (Panel Data) models from the standard problems of the agricultural import value model.

Variables	Coefficient	(Regression Model Pooled)	p-value
LnImpij			
LnGDPi	8.187		0.001 (***)
LnGDPj	2.267		0.000 (***)
LnDistij	-1.888		0.000 (***)
LnPOPi	-13.211		0.015 (**)
LnPOPj	-1.952		0.003 (***)
LnAGRi	0.686		0.241 (no)
LnAGRj	1.306		0.009 (***)
Contig (D1)	4.556		0.000 (***)
Comlang (D2)	5.673		0.000 (***)
Constant	-28.285		0.551
R-squared	0.65		
F-test	29.20		0.000
Significant	(*)Significant at the 10% ; (**)Significant at the 5% ; (***) Significant at the 1% and (no) Not Significant		

Source: Prepared by the researcher based on the outputs of the (Stata17) program.