Determinants of imports between Algeria and the AMU member countries: A gravity model approach

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Abstract :

This study aims to identify and analyze the most important variables that explain national imports with the countries of the Arab Maghreb. Algerian towards the countries of the Maghreb and the most important variables explaining the intra-regional trade between this regional bloc using the random effects model.

The moral determinants explaining the Algerian imports towards the countries of the Arab Maghreb Union were reached, where each of the market size represented by the number of population and the GDP of the member states had a positive impact on the increase in the volume of Algerian imports towards the Arab Maghreb countries during the study period. The study also found that the distance also had a positive effect on The volume of Algerian imports, which explains the increase in Algerian exchanges with geographically distant countries.

*Key Words***:** : Gravity model - Algerian imports- Panel data - Maghreb - intra-trade

JEL Classification : F14, F15, C23

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Introduction :

All the theories explaining international trade participated in calling for the liberalization of trade between countries, but the results reached by these theories, whether classical or modern, are applied to developed countries. As for developing countries, by virtue of their characteristics, the application of the principle of total liberalization of international trade requires caution and here emerges bloc or economic integration as one of the strategic options for trade liberalization in developing countries.

Through economic integration, developing countries can take advantage of the advantages of specialization among the countries under integration to achieve the advantages of production savings, which enables them to reduce production costs and thus achieve the competitiveness of the local product at the international level, in addition to strengthening its international position in front of the rest of the world, which allows the development of its negotiating capabilities with the rest of the world. countries and other economic blocs.

The idea of establishing the Arab Maghreb Union appeared since the late fifties of the last century. In order to translate this idea on the ground, the Maghreb countries held several meetings that focused on discussing ways of cooperation between the countries of the region. These meetings culminated in the signing of the Marrakesh Treaty on February 17, 1989, which announced the birth of the Arab Maghreb Union (Finaish, Mohamad Ali, & Eric Bell, 1994).

The countries of the Maghreb are classified among the countries of the South and have a strategic location that enables them to connect on the continent and water with the rest of the world, especially the European Union and the United States of America. The countries of the Arab Maghreb Union are in the process of integration because they are linked to the world arena through the movement of productive and financial exchanges. However, this integration remains marginal and dependent and does not amount to full integration, as is the case in the European Union and the United State.

Despite the numerous agreements signed between the countries of the Union in the field of trade liberalization among the member states, the level of trade exchange between the countries of the region remains weak compared to the countries of the European Union and the Asian blocs.

Research goal: This is why we aim through this research paper to identify the most important determinants of Algerian imports from the Maghreb countries (Libya-Morocco-Tunisia-Mauritania) to identify the factors leading to this weakness and to search for ways to enhance trade exchanges for member states. Therefore, the following problem can be posed:

What are the most important factors affecting Algerian imports from the Maghreb countries according to the gravity model during the period (2000-2019) ?

Hypotheses:
- The size of the local market of UMA'S countries is one of the factors affecting Algeria's imports.
- Distance negatively affects the volume of trade exchanges between Algeria and Maghreb countries.

Research Methodology: Study methodology: The research relied on the descriptive statistical method, by analyzing the data of Algerian imports from the Arab Maghreb countries, as well as on the standard quantitative statistical method, by estimating the gravity model using the Data Panel for the Arab Maghreb countries.

I. Literature reviews:
Many previous studies dealt with the issue of the determinants of intra-regional trade in various regional economic blocs worldwide and the model used in most studies to analyse the determinants of intra-trade was the gravity model.
(Ekanayake & John R, 2009) analyzes the intra-regional trade and investment flows in the Middle East and North Africa (MENA) region using an augmented gravity model applied to panel data for the period 1980-2006 This study was concerned with measuring the effect of the real exchange rate on the volume of trade exchanges and

found that the real exchange rate had a positive impact on trade flows between the countries of the study sample.

(Iqbal & ATM Fakhrul Islam, 2014)These studies focused on the promotion of free trade between India, Bangladesh, and the European Union for the period 1980-2010 this study was concerned with measuring the effect of the real exchange rate on the volume of trade exchanges and found that Lower real exchange rate and introduces cost effective, diversified and well designed products can improve exports capacity of Bangladesh with the EU.

(Aftab & Ijaz Ur Rehman, 2017)This paper aims to examine the influence of exchange rate risk on the bilateral trade of two closely connected East Asian open economies – Malaysia and Singapore – at industry level with Singapore using monthly data over the period 2000-2014.The findings suggest that exchange risk has an impact on a moderate number of industries in the short run; however, this influence endures in very few industries in the long run. It is interesting to note that exchange rate volatility expedites import demand for the large Malaysian import industries like gas and plastic.

(Abdmoulah, 2011) Examined the determinants of trade flows in Arab regional trade agreement (UMA-GAFTA-AGADIR-GCC) for the period 1997-2008

His results indicate that there are positive impact of gross domestic production (GDP) and negative effect of geographical distance on exports flows in Twenty-seven Arab countries , while , GCC,UMA and AGADIR suggested disappoint trade gains results this can be explained by oil dominance persistent barriers and by increasing trade flows of APEC members countries.

 (Alamri, 2020) Analyzes the significant factors affecting intra-GCC trade flows, in order to evaluate the status of intra-GCC trade during 1989-2014using gravity model. He detected that there is a positive correlation between GCC GDP in import and export, as well as a negative impact for each of the gross domestic products, geographic distance and the population rate in the four countries under study.

(Pietrzak & Justyna Łapińska, 2015) this study focused on the issue of trade exchange between European Union member states using the panel gravity model in the years 1999–2010The research outcome enabled us to draw a conclusion on a positive dependence between a member state's GDP and its export and import volume. In the case of foreign direct investments, their positive impact on the improvement of member states' exporting potential was identified. Moreover, a negative dependence between the geographical distance and the size of their trade exchange was proved. Also, the paper discussed the impact of EU membership on increasing trade exchange volume. The research found an essential increase in exports from the new EU-12 countries to the EU-15 countries and inversely.

(Kareem, Inmaculada Martinez-Zarzoso, & Bernhard Brümmer , 2016) they analyze Fitting the Gravity Model when Zero Trade Flows are Frequent:(a Comparison of Estimation Techniques using Africa's Trade Data) analysis was based on a dataset of Africa's fish exports to the European Union between 2007 and 2012 .They find EU standards are indeed non-protectionist in spite of the high level of African fish exports rejected since 2008 at the EU border. Thus, a deeper trade agreement

between these trading partners involving a significant transfer in science and technology to Africa could help improve their compliance rate to EU standards and ensure increased export penetration.

(Fakher, 2018) the study measure the impact of the state's institutional performance on trade flows in theory and practice in Egypt during the period 1995-2014 This study found that the determinants of the institution have a positive and moral impact on trade flows in Egypt during the study period and support the results with the institutional role that works to create the appropriate business climate and helps the State of Egypt and other developing countries to stimulate the volume of their investments and trade and to be able to integrate into the global economy.

(Alhwij, Mohamed Lamine Belhouchet, & Ali Gaboussa, 2019)The main aim of this study was to investigate the determinants of bilateral trade flows among the Arab Maghreb Union AMU countries, during the period of 1985-2017 using panel data cointegration tests. In addition, it has used the D-OLS method to estimate the long run coefficients. The basic findings of the study has supported the existence of a long run equilibrium relationship among the model variables. Furthermore, a positive and significant long run relationship between GDP and Bilateral exports has been found. However, long run coefficients of exchange rate, export concentration index and colonial heritage variable have been found to be negative and significant.

II- Methodology and model specification:
1- The gravity model :
The gravity model was first applied to international trade studies by (Tinbergen, 1962; Poyhonen, 1963) to analyze the patterns of bilateral trade flows among the European countries used an analogy with Newton's universal law of gravitation to describe the patterns of bilateral aggregate trade flows between two countries i and j as "proportional to the gross national products of those countries and inversely proportional to the distance between them. (Abidin, Jantan, Mohd, & Haseeb, 2021). The gravity model applied in this study is based on the gravity model used by Sharma and Chua (2000) and Rahman (2003, 2009). However, the gravity model used in this study departs from Sharma and Chua (2000) and Rahman (2003, 2009) Employing panel data analysis using a gravity model, the years estimated is in the period of 2000-2019.

With the aim of covering all aspects of the problem presented through this study, which mainly revolves around determining the variables affecting the volume of Algeria's imports from the Maghreb countries during the period (1990 - 2019). Applied literature that dealt with the subject of the research according to the estimation methodology of gravity models, and the general formulation of the study model can be written as follows:

$$lnIMPO_{it} = \hat{\beta}_0 + \hat{\beta}_1 lnGDPj_t + \hat{\beta}_2 lnGDPi_t + \hat{\beta}_3 lnPj_t + \hat{\beta}_4 lnPi_t + \hat{\beta}_5 lnDistij_t$$
$$+ \hat{\beta}_6 lnINSj_t + \hat{\beta}_7 lnINSi_t + \hat{\beta}_8 lnERj_t + \hat{\beta}_9 lnEri_t$$
$$+ \hat{\beta}_{10} lnTRGDPj_t + \hat{\beta}_{11} lnTRGDPi_t + \hat{\beta}_{12} lnINFi_t + \hat{\beta}_{13} lnINFj_t$$
$$+ \hat{\beta}_{14} lnFDIii_t + \hat{\beta}_{15} lnFDIj_t + \hat{\beta}_{16} Dum7AGADIRij_t$$
$$+ \hat{\beta}_{17} Dum9OPECij_t + \varepsilon_{it} \qquad (n: 1 \dots N)(t = 1 \dots T)$$

Where:
IMPOijt = Country i (Algeria) imports from country j (in US$ Thousand)
GDPi = Gross Domestic Product of country i
GDPj= Gross Domestic Product of country j,
PCGDPi = per capita GDP of country i,
PCGDPj = per capita GDP of country
ERit = the real effective exchange rate index country i (2000=100).
ERjt = the real effective exchange rate index country j (2000=100)
INFit = Inflation rate for country i,
INFjt = Inflation rate for country j,
TR/GDPit = Trade/GDP ratio of country i,
TR/GDPjt = Trade/GDP ratio of country j,
FDIit= Foreign Direct Investment inflows for country i
FDIjt= Foreign Direct Investment inflows for country j
D=Distance between county *i* capital to country *j* capital (in kilometers)
INSit=Corruption perceptions index of country *i*
INSjt=Corruption perceptions index of country *j*,
ijt = error termε
t = time period;
, $\sigma 0$ = parameters.β

2- Sources of Data:
- The data used are yearly span for the period of 2000-2019 Data on Gross Domestic Product (GDP; population; are obtained from the Word Development Indicators (WDI) database of the Word Bank and from International Financial Statistic (IFS).
- Data on foreign direct investment; real exchange rate; Consumer Price Index (CPI) ; trade (%GDP) are obtained from Perspective Monde (School of Applied Politics Faculty of Letters and Human Sciences University of Sherbrook, Quebec, Canada) and retrieved from database at :https://perspective.usherbrooke.ca.
- Data on the distance (in Kilometer) between Algiers (capital of Algeria) and other capital cities of country j are obtained from a website: http://www.indo.com/distance.
- For measurement of level of institutional quality that measured by the corruption index obtained from Transparency International (TI) and retrieved from database at : ttps://www.transparency.org

- Data on Algeria's imports(country i imports) from other countries (country j's) are obtained from Word Integrated Trade Solution (WITS)and retrieved from database at: https://wits.worldbank.org

3- Empirical Results:

As mentioned above, the methodology of gravity model, that measures the determinants of imports between Algeria and the Maghreb countries (Tunisia, Morocco, Libya, and Mauritania).

In view of the nature of the data adopted in this study, which represents a mixture between time series and cross-sectional data, estimation methods were used for the panel data (the static panel models in this study), in the same context and with regard to the selection of a sample of the target countries of this study (the Arab Maghreb countries) On the basis of regional rapprochement and the many commonalities between Algeria and these countries.

4- Descriptive data analysis:

Before starting the estimation process, the most important statistical characteristics of the data adopted in this research must be presented, by focusing on the most important statistics of central tendency for the main variables in this study, in addition to trying to know the direction of the relationship between the dependent variables and the independent variables approved in them.

5- Descriptive analysis of variables:

In order to give an initial perception about the data adopted in the study, the following attempt will be made to display the most important statistical characteristics of these data by presenting a set of central tendency statistics for the main variables in this study, which is what the following table shows:

Table (1): Descriptive analysis of the study variables

Variable	Obs	Mean	Std. Dev.	Min	Max
IMPO	80	668784.2	1437480	0.183	5730037
INFj	80	3.821618	5.201157	-9.797647	28.047
INSj	80	35.3625	18.99916	1	68
INFi	80	3.933785	1.919475	0.3391632	8.891451
INSi	80	30.7	5.790433	18	40
GDPj	80	43.82588	33.21648	1.74	119.7
GDPi	80	140.8389	53.10936	54.745	213.8

Source: Prepared by the researcher based on the outputs of the Eviews12

By examining the figures shown in the above table, the following observations can be made:

The arithmetic average of Algeria's imports to the Arab Maghreb countries amounted to (668784.2 million dollars) While the arithmetic average of GDP in Algeria and the general average of the Maghreb countries, respectively (43.62; 140.83), On the other hand, the highest value of Algeria's exports to the Maghreb countries was (1.16E + 07 million dollars) during the year 2012, and the lowest value of Algeria's exports to the Maghreb countries was estimated at (183.5 million dollars) in Libya during the period 2000.

As for Algeria's imports from the Maghreb countries (INPO), they reached their peak (5730037 million dollars) with Mauritania during the year 2014, while the lowest value for Algeria's imports from the Maghreb countries reached (0.183) with Libya also during the 2016 period. Economic analysis.

With regard to the standard deviation of the study variables, it appears that there is a large variation in its values between the variables, where the highest values of the standard deviation where recorded in the variables of imports (INPO), while the lowest values of the standard deviation where recorded in the two variables (INFI; INSI) and this variance is due to several considerations, the first of which is The difference in units of the study variables, which was exceeded by the introduction of the natural logarithm on all these variables, to ensure the homogeneity of the units and the linear relationship between the latter, in addition to the existence of a discrepancy between the countries of the Maghreb in the variables included in this study and therefore it can be judged based on the results of the standard deviation to There is a clear dispersion in the observations of the study variables between the sections (countries) during the whole study period.

6- Correlation study:

In order to determine the nature and directions of the correlation between dependent and independent variables, we use the following matrix:

Table (2): Correlation matrix between variables

Variables	Variables		
	lnIMPO		lnIMPO
		lnERj	0.0181
lnIMPO	1	lnEri	0.4185
lnGDPj	0.0124	lnTRGDPj	0.2561
lnGDPi	0.4194	lnTRGDPi	-0.1
lnGDPPj	-0.1817	lnINFi	0.2198
lnGDPPi	0.4036	lnINFj	0.0296
lnDistij	-0.3864	lnFDIii	-0.2164
lnINSj	0.3959	lnFDIj	0.0549
lnINSi	0.2807		

Source: Prepared by researchers based on the outputs of the Eviews12

Referring to the previous table it appears that there is a relatively weak correlation between Algeria's imports with the Arab Maghreb countries and the rest of the explanatory variables in the model adopted in this study. Imports on the one hand and the variables of per capita gross domestic product (LNGDPPI) and the distance variable (LNDISTII) and foreign direct investment to Algeria (LNFDII).

7- Homogeneity test results (HSIAO Test Results):

This test is considered a basic and necessary stage before estimating the Panel models, through which the methodology used in the estimation process is judged in the model that measure the determinants of Algeria's imports with the Maghreb countries, and through it the extent of homogeneity of the estimated parameters (sections and tendencies) was determined, and thus the type of Individual effects between study sections (countries) according to the strategy proposed by (HSIAO 1986) and based on the EVIEWS12 program, the following results were obtained.

Table (3): HSIAO Test Results

	imports model	
Hypotheses	F-Stat	P-Value
H1	29.48235	1.47E-17
H2	3.203875	0.028199
H3	51.24346	3.98E-18

Source: Prepared by the researcher based on the outputs of the Eviews12

Referring to the previous table (3) shows that the Fisher value calculated in the first step of the **Hassio** strategy, which is equal to (F-Stat= 29.84) for the import model, respectively , with a probability (P-value) less than 0.05, and therefore we can reject the null hypothesis that the partitions are homogeneous And the constants (total homogeneity) between the sections, and the same decision for the second and third steps related to the homogeneity of the constants and tendencies for the import model , i.e. the null hypothesis was rejected, i.e. the heterogeneity of the slopes and cutouts individually in the panel structure of the model under study, and accordingly the study model contain: Individual fixed and random effects according to Hassio's homogeneity strategy, and in the following this result will be confirmed based on Haussmann's test and the comparison between fixed and random effects.

8- Hausman test:

Based on the results of the HSIAO Test, which confirmed the existence of individual effects between each individual and another (country), the type of these effects (fixed or random) must be determined, and thus a comparison between the fixed effects

model (FEM) and the random effect model (REM) for its adoption in the process Analysis, using (Hausman test).

Hausman test hypotheses:

$\begin{cases} H_0 \ldots\ldots\ldots \text{ A random effects model is appropriate} \\ H_1 \ldots\ldots\ldots \text{.. The fixed effects model is appropriate} \end{cases}$

Table (4): Hausman test results

Correlated Random Effects - Hausman Test			
Test cross-section random effects			
The model: lnMPO imports			
Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	4.652132	11	0.0799

Source: Prepared by the researcher based on the outputs of the Eviews12

By comparing the calculated chi2 statistical values (at a degree of freedom of 11 and a level of significance of 5%) with the tabular value of the model of imports,, we find that the calculated values ($\aleph^2 = 4.65$) is less than the corresponding tabular values, which is confirmed by the probabilities of the model , (0.07) It is greater than the critical value (0.05), and accordingly we reject the null hypothesis an d accept the null hypothesis. Therefore, the appropriate model is the random effects model, which will be adopted in the statistical and economic analysis processes.

III- Statistical and economic analysis of study model:

Through previous tests that confirmed that the most appropriate model for the study data is the random effects model in the case of imports.

Table (5): Results of the Random Effects Model Estimation

Number of obs			80			
Number of groups			4			
lnIMPO dependent variable						
	Coef.	z	P>z		Coef.	z	P>z
Dum7AGADIR	106.126	3.34	0.001	lnEri	3.695295	1.29	0.196
Dum9OPEC	-35.8773	-5.37	0	lnTRGDPj	1.84387	1.18	0.239
lnGDPj	3.06416	2.56	0.01	lnTRGDPi	-10.9305	-2.02	0.043
lnGDPi	-2.23591	-0.62	0.533	lnINFi	0.191482	0.62	0.538
lnPj	12.7554	2.63	0.009	lnINFj	-1.10437	-2.98	0.003
lnPi	-17.6447	-1.6	0.109	lnFDIii	-1.56522	-2.57	0.01
lnDistij	320.201	3.49	0	lnFDIj	0.377457	0.83	0.407
lnINSj	-0.33363	-0.8	0.425	_cons	-2255.78	-3.38	0.001
lnINSi	1.19257	0.75	0.452	R-sq			0.8261
lnERj	0.73953	0.42	0.672	Wald-chi2(17)			294.43

Source: Prepared by the researcher based on the outputs of the Eviews12

As for the partial significance of the random effects model estimated above, we find that the majority of the estimated parameters are statistically significant at a significance level of less than 5%, given that the probabilities of the Student statistics for most of the estimated parameters are less than the critical value (0.05), saluting the parameters associated with the dummy variables (Dum9OPEC). ; Dum7AGADIR) was statistically significant at the level of significance 1%, as the statistical value of the study for these parameters amounted to, respectively ($t_{Statistic} = 3.34$; -5.73) It is a statistical function given that its probability value is ($Prop_{t-stat} = 0.001$; 0.000) < 0.01) In addition, the parameters associated with the variables of per capita GDP in the Maghreb countries and their total output (lnGDPj; GDPj) and the distance between Algeria and each country (lnDistij) were statistically significant also at the level of significance of 5%, where the probabilities of the student statistic for the aforementioned parameters are, respectively,(0.00 ٠ 0.01) It is less than the critical value (0.05), and the parameters associated with exchange rate variables, market size (total population), The total trade and foreign direct investment incoming to the countries of the Arab Maghreb appeared statistically significant, because the probability value of the Studnet statistic related to the aforementioned variables are all less than the critical value (0.05); On the other hand, the rest of the variables did not provide any statistical significance, and on the other hand, the constant in the random effects model does not provide any significance from the statistical and economic perspectives.

Through the above estimated model, we find that the calculated value of (Wald-chi2) reached (294.43) with a critical probability value ($Prop_{Wald(17)} = 0.00 < 0.05$) That is, the model is entirely moral; With regard to the explanatory power of the model, the quality of conciliation expressed by the coefficient of determination (R2=0.82) i.e. the independent variables explain the changes in the volume of Algeria's imports from the Maghreb countries by more than 82%, which is a high percentage that reflects the ability of the variables included in this model to explain changes in the volume of imports. Algeria's imports from the Maghreb countries, and the remaining 18% is explained by other variables that were not included in the model or to errors in the description, but they are included with a margin of error.

From an economic point of view, it appears that the sign of the parameter associated with the gross domestic product in the countries of the Maghreb (lnGDPj) is positive, and therefore the volume of the GDP in the Maghreb countries has a positive impact on Algeria's imports from them, as an increase in the volume of GDP in the Maghreb countries by 100% increases the volume of Algeria's imports from them by 3.06 % The same result is for the total population variable (the size of the domestic market for the countries of Morocco), which positively affected Algeria's imports from it

with an elasticity of 12.75%, which is a high flexibility compared to the impact imposed by the GDP variable.

The positive sign of the parameter associated with the distance variable indicates the positive impact that the latter plays on the volume of Algeria's imports from the Maghreb countries, as increasing the distance by (100%) leads to an increase in imports from the sample countries by more than (320%). By reviewing the results, it appears that the countries that are farther away, Algeria's exchanges with them are greater. As for the variables of total trade in the Maghreb countries and their inflation rates, in addition to the volume of foreign direct investment coming to Algeria, they had a negative impact on Algeria's imports from these countries, with elasticity's estimated at (10.93, 1.10 and 1.56%) respectively.

Finally, the dummy variable that expresses whether the country joined OPEC or not (Dum9OPEC) had a negative impact on Algeria's imports from the Maghreb countries and the second variable (Dum7AGADIR) had a positive impact on the volume of Algeria's imports .

Conclusion:

Through the study, we tried to identify the most important factors affecting the volume of imports between Algeria and Maghreb countries during the period (2000-2019) through a standard study of the dependent variable represented in the volume of intra-regional imports and the independent variables represented in the gross domestic product; population; distance; direct foreign investment ;real exchange rate; Consumer Price Index (CPI); The percentage of trade in relation to the gross domestic product and the quality indicator of institutions using the gravity model and the panel data approach. After estimating the model, the study reached the following results and recommendations:

- The volume of imports between Algeria and the Maghreb countries is weak despite their common factors.
- The random effects model is the appropriate model for the study, and this is due to the distinctiveness of each country from the other, such as population density and structural differences between the economies of the Maghreb countries.
- The impact of the GDP of Algeria and the Maghreb countries during the study period positively on the development of the volume of imports from the Maghreb countries.

Test Validity of hypotheses:

- o Acceptance of the first hypothesis: The size of the local market of UMA'S countries is one of the factors affecting Algeria's imports.
- o Rejection of the second hypothesis: Distance positively affects the volume of trade exchanges between Algeria and Maghreb countries.

o **Recommendations:**

o There must be a strategy for economic integration between the Maghreb countries and the strengthening of inter-cooperation between them in order to create joint production projects, which would serve as sustainable sources of income for the five countries and provide huge job opportunities.

o Create an enabling environment for private sector activity to stimulate innovation, attract foreign investment by improving infrastructure, increase access to finance, implement structural reforms to strengthen legal and regulatory frameworks, further improve the business climate, and reduce the role of state-owned enterprises in the economy.

o Address the growing financial vulnerabilities, and this requires consolidation and financial consolidation to reduce excessive debt obligations and rebuild financial stores.

o Establishment of national banks and institutions to finance trade and guarantee export credit within the Maghreb in order to revive trade exchange within it.

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Appendices:

Appendix 01: Hassio . test

Specification Tests of Hsiao (1986)

H1 = Null Hypothesis : panel is homogeneous vs Alternative Hypothesis : H2
H2 = Null Hypothesis : H3 vs Alternative Hypothesis : panel is heterogeneous
H3 = Null Hypothesis : panel is homogeneous vs Alternative Hypothesis : panel is partially homoge

Hypotheses	F-Stat	P-Value
H1	29.48235	1.47E-17
H2	3.203875	0.028199
H3	51.24346	3.98E-18

This program has developed by Brahim KHOUILED
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Source: (EVIEWS 12) program outputs

Appendix 02: Estimated Models

Aggregate regression model

Source	SS	df	MS			
Model	412.504056	17	24.2649445			
Residual	104.899181	62	1.69192227			
Total	517.403236	79	6.54940806			

Number of obs = 80
F(17, 62) = 14.34
Prob > F = 0.0000
R-squared = 0.7973
Adj R-squared = 0.7417
Root MSE = 1.3007

lnEXPO	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
Dum7AGADIR	169.3478	29.22612	5.79	0.000	110.9256	227.77
Dum9OPEC	-37.69686	6.149294	-6.13	0.000	-49.98912	-25.40459
lnGDPj	-1.660415	1.100741	-1.51	0.137	-3.860765	.5399345
lnGDPi	1.988628	3.301409	0.60	0.549	-4.610794	8.588051
lnPj	26.10498	4.468842	5.84	0.000	17.17189	35.03807
lnPi	-18.84771	10.14252	-1.86	0.068	-39.12232	1.426899
lnDistij	493.9596	84.55891	5.84	0.000	324.9288	662.9905
lnINSj	.6400768	.3847233	1.66	0.101	-.1289742	1.409128
lnINSi	-.7231696	1.459473	-0.50	0.622	-3.640614	2.194275
lnERj	.4874383	1.607375	0.30	0.763	-2.725658	3.700535
lnERi	1.740627	2.633172	0.66	0.511	-3.523009	7.004264
lnTRGDPj	1.262275	1.440337	0.88	0.384	-1.616917	4.141467
lnTRGDPi	-6.396909	4.975613	-1.29	0.203	-16.34302	3.5492
lnINFi	-.0636556	.2860162	-0.22	0.825	-.6353938	.5080826
lnINFj	-.0704447	.3416285	-0.21	0.837	-.7533504	.612461
lnFDIii	-.1408108	.559763	-0.25	0.802	-1.259761	.9781395
lnFDIj	.5528323	.419364	1.32	0.192	-.2854645	1.391129
_cons	-3554.551	614.7474	-5.78	0.000	-4783.414	-2325.689

Fixed Effects Model

Fixed-effects (within) regression   Number of obs = 80
Group variable: code   Number of groups = 4

R-sq:
   within = 0.7145
   between = 0.0015
   overall = 0.0145

Obs per group:
   min = 20
   avg = 20.0
   max = 20

F(14,62) = 11.00
Prob > F = 0.0000

corr(u_i, Xb) = -0.9795

lnIMPO	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
Dum7AGADIR	0	(omitted)				
Dum9OPEC	0	(omitted)				
lnGDPj	3.064164	1.195954	2.56	0.013	.6734859	5.454842
lnGDPi	-2.235919	3.586978	-0.62	0.535	-9.406186	4.934348
lnPj	12.75545	4.855393	2.63	0.011	3.049652	22.46124
lnPi	-17.6447	11.01984	-1.60	0.114	-39.67305	4.383649
lnDistij	0	(omitted)				
lnINSj	-.3336303	.4180016	-0.80	0.428	-1.169204	.501943
lnINSi	1.192576	1.585716	0.75	0.455	-1.977226	4.362377
lnERj	.73953	1.746412	0.42	0.673	-2.751497	4.230557
lnERi	3.695295	2.86894	1.29	0.201	-2.023642	9.414232
lnTRGDPj	1.84387	1.564925	1.18	0.243	-1.28437	4.972109
lnTRGDPi	-10.93058	5.486	-2.02	0.048	-21.73782	-.1241398
lnINFi	.1914825	.3107564	0.62	0.540	-.4297106	.8126756
lnINFj	-1.104379	.3711791	-2.98	0.004	-1.846356	-.3624029
lnFDIii	-1.565226	.608182	-2.57	0.012	-2.780965	-.3494877
lnFDIj	.3774574	.6556387	0.83	0.411	-.5333514	1.288266
_cons	60.70233	53.15921	1.14	0.258	-45.56141	166.9661

sigma_u   15.40477
sigma_e   1.413252
rho   .9916538   (fraction of variance due to u_i)

F test that all u_i=0: F(3, 62) = 20.91   Prob > F = 0.0000

Random effects model

Random-effects GLS regression   Number of obs = 80
Group variable: code   Number of groups = 4

R-sq:
   within = 0.6915
   between = 1.0000
   overall = 0.7973

Obs per group:
   min = 20
   avg = 20.0
   max = 20

Wald chi2(17) = 243.81
Prob > chi2 = 0.0000

corr(u_i, X) = 0 (assumed)

lnEXPO	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
Dum7AGADIR	169.3478	29.22612	5.79	0.000	112.0656	226.6299
Dum9OPEC	-37.69686	6.149294	-6.13	0.000	-49.74925	-25.64446
lnGDPj	-1.660415	1.100741	-1.51	0.131	-3.817828	.4969973
lnGDPi	1.988628	3.301409	0.60	0.547	-4.482014	8.459271
lnPj	26.10498	4.468842	5.84	0.000	17.34621	34.86375
lnPi	-18.84771	10.14252	-1.86	0.063	-38.72669	1.031264
lnDistij	493.9596	84.55891	5.84	0.000	328.2272	659.692
lnINSj	.6400768	.3847233	1.66	0.096	-.1139671	1.394121
lnINSi	-.7231696	1.459473	-0.50	0.620	-3.583684	2.137345
lnERj	.4874383	1.607375	0.30	0.762	-2.662959	3.637835
lnERi	1.740627	2.633172	0.66	0.509	-3.420296	6.90155
lnTRGDPj	1.262275	1.440337	0.88	0.381	-1.560733	4.085283
lnTRGDPi	-6.396909	4.975613	-1.29	0.199	-16.14893	3.355114
lnINFi	-.0636556	.2860162	-0.22	0.824	-.624237	.4969258
lnINFj	-.0704447	.3416285	-0.21	0.837	-.7400243	.5991349
lnFDIii	-.1408108	.559763	-0.25	0.801	-1.237926	.9563045
lnFDIj	.5528323	.419364	1.32	0.187	-.2691061	1.374771
_cons	-3554.551	614.7474	-5.78	0.000	-4759.434	-2349.669

sigma_u   0
sigma_e   1.3007391
rho   0   (fraction of variance due to u_i)

Source: (EVIEWS 12) program outputs