International Journal of Humanities
and Social Sciences (IJHSS)
ISSN(P): 2319-393X; ISSN(E): 2319-3948
Vol. 3, Issue 2, Mar 2014, 101-116

International Academy of Science,
Engineering and Technology
Connecting Researchers; Nurturing Innovations

ESTIMATE THE GRAVITY MODEL OF THE UNITED STATES OF AMERICA AND SOME COUNTRIES FOR THE PERIOD FROM 1991-2011 -AN ECONOMETRIC STUDY

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ABSTRACT

The model of gravity which is used in foreign trade by many Western researchers to estimate the impact of different economic policies on exports, in addition to its use in measuring the impact of preferential trade agreements, currency unions, and economic cartel's on the economies of countries of the Organization of such gatherings, with reference to a large group of economists Americans, Canadians and Mexicans used it after signing the Free Trade Agreement NAFTA North American countries to measure the impact of that Convention on trade flows between these countries, the model has been mentioned wide popularity among economists because of its success in clarifying the trade flows between countries are simplified, A lot of studies that applied the gravity model In this study, the application of gravity model on the U.S. trade with selected countries, namely, (Australia, Turkey, South Korea, United Kingdom, Algeria) and was selected as a result of a number of considerations Show of models that estimate the gravity model between the United States and China was one of the best models in recognition and comes then respectively the United Kingdom and then Canada.and U.S. exports to China face different restrictions do it Chinese law. Contrast that the U.S. began to impose strict restrictions direction of trade with China and.Started in the United States to promote exports to the world restrictions easier than it was previously.

KEYWORDS: Economics, Gravity, Foreign Trade, Economic Policies

INTRODUCTION

Result of foreign trade on a major role in the economies of countries, as confirmed most of the theories of development at this role, as a result of the growing prestige, especially after the emergence of economic schools which called for free trade at the international level and the need to lift the restrictions that stand in its face, there have been many economic models to describe the flows foreign trade, and the knowledge of the factors that affect them, and between those models of gravity model. The gravity model in foreign trade is similar to other gravity models in astronomy, sociology, and based on the same assumptions that were based upon models of gravity in that science, which is that trade flows between two countries depends on the economic quantities of both countries and the distance between them. It has been applied to model gravity in foreign trade since 1931 by the U.S. Economic William Joseph Reilly, and then by U.S. economic Walter Isard in the science of 1954, as well as Russia's economic Wassily Leontief in the same year, but some Arabic studies on their limitations, did not mention applications of Reilly, and Isard, and Leontief model of gravity, and relied on applications by Jan Tinbergen in 1962 and Poyhonen in 1963, so we believe that the reason for this shortcoming is the lack of scientific material in this area in the Arabic economic literature.

The model of gravity which is used in foreign trade by many Western researchers to estimate the impact of different economic policies on exports, in addition to its use in measuring the impact of preferential trade agreements,

currency unions, and economic cartel's on the economies of countries of the Organization of such gatherings, with reference to a large group of economists Americans, Canadians and Mexicans used it after signing the Free Trade Agreement NAFTA North American countries to measure the impact of that Convention on trade flows between these countries, the model has been mentioned wide popularity among economists because of its success in clarifying the trade flows between countries are simplified, A lot of studies that applied the gravity model such as (James E. Anderson 1970), (Alan V. Deardroff 1995), (Howard J. Will 2000), (Dr. Hassan Kalasi 2001), (Jon Hoveman 2001), (Jaya Krishnakumal 2002), (Carlos Carrillo 2002), (Andrew K. Rose 2002), (Keith Head 2003), (Amita Batra 2004), (Chan-Hyun Sohn 2005), (Jokim Westerlund 2006), (Mohammed Mafizer Rahman 2006).

The problem of this search deal with the situation of trade between U.S.A and other countries it faces many constrains from U.S.A and world Organizations accordantly to these constrains we are don't have any knowledge which country attractive the other countries by using the foreign trade.

The objectives of this study as following

- Estimate the gravity model of the United States with Canada
- Estimate the gravity model of the United States with United Kingdom
- Estimate the gravity model of the United States with China

In this study, the application of gravity model on the U.S. trade with selected countries, namely, (Canada, United Kingdom and China) and was selected as a result of a number of considerations, as follows:

- Choose a country from each continent, a continent of North America, China from Asia, the United Kingdom from the continent of Europe.
- Choice of the countries in similar condition with the United States and other countries, with different language, the United Kingdom speaks English, and China, speaks Chinese, and Canada speaks English.
- There is variation in the distances between countries that have been selected and the United States.
- There are countries that have a colonial past and the wars with the United States (such as the United Kingdom).
- There is disparity between selected countries in the size of GDP.
- There is disparity between selected countries in the population.

The choices made by the above variables within the model are of two types; the essential variables are representing (GDP, population, distance between the countries under study) and the secondary variables (language, trade agreements, and the colonial past).

THE MODEL

There are several models of gravity, but in this study adopted the model of (James. Anderson 1979) model was derived novelty more than the other models, as follows:

Suppose That

Mj: The size of the income spent by the country (j) on all goods from any source and we suppose the country (i).

Sij: Share (Mj) spent on goods from the country (i).

For this:$F_{ij} = S_{ij}M_{ig}$

Here, Must be Sij

- Value of between zero and one.
- Must be increased, if the country (i) has produced a variety of goods and symbolized by η_i), but if the product is high quality it signifies(μ_i).
- Must be reduced according to the trade barriers between the two countries such as the distance (D).

From above is possible that the new equation is as follows:

$$S_{ij} = \frac{g(\mu_i,\eta_i,D_{ij})}{\sum_e g(\mu_e,\eta_e,D_{ej})}$$

Here, the function $g(\mu_e, \eta_e, D_{ej})$shall be increased in the first, and go down in all the values that the fact that the (Sij> o), and until we reach our goal.

The second way, according to Anderson, is the assumption that there is one commodity for each country, if that (η_i)is equal to the correct one, but allows for the fixed factor (μ_i) inequality across countries subject to the restrictions varied technology markets.

As for the distance, both countries will be a function of trade costs after the spatial between them.

Here, Anderson confirmed that both (η_i)and (μ_i) will be uneven across countries and, therefore:

$$g(\mu_i, \eta_i,) = \sum_{V=1}^{\eta_i} \left(\frac{P_{i_{jv}}}{\mu_{i_{jv}}}\right)^{1-\alpha}$$

As

V: Refer to index a variety of goods which can be replaced with flexibility given to a replacement (α).

If the goods from the same country with a diverse range but similar in the rate of quality and cost of transport, it can drop (V) and we make:

$$g(\mu_i, \eta_i) = \eta_i \left(\frac{P_{ij}}{\mu_{ij}}\right)^{1-\alpha}$$

The next step deal with the receiving price compared to the same commodity price in the country of origin, and transportation costs between the two countries, here Anderson assumed the following equation:

$$\frac{P_{ij}}{\mu_{ij}} = \left(\frac{P_i}{\mu_i}\right) D_{ij}^{\delta}$$

While noting that in the equation of gravity core there is a far from reality is the absence of differences of price, and that this is not a completely unrealistic as it seems at first glance - it requires us only to be Delivery prices varying in proportion to the quality of products, of the country of export, in other words:

$$P_i/\mu_i \approx K$$

The important observation here is that the levels of quality of goods in each country (η_i) is one of the things that cannot be too we observe directly, so it can take advantage of the assumed model (Stiglitz) (that all companies are the same size) and in this case be:

$$\eta_i = M_i/\alpha$$

$\boldsymbol{\alpha}$**:** Company size

To maximize the latter assumptions, we assume that: $\theta \equiv \delta(\alpha - 1) \geq 0$

To get of: $g(\mu_i, \eta_i) = \frac{M_i D^{-\theta}}{qk^{\alpha-1}}$ This is indicated by the market shares of exporters (i) in the country (j) for: $S_{ij} = M_i D_{ij}^{-\theta} R_j$, if $R_j = \frac{1}{(\sum eMeD_{ij}^{-\theta})}$ after the compensation and re-arrangement we obtain a result very close to are: $F_{ij} = R_j \frac{M_i M_j}{D_{ij}^{\theta}}$

Remained the main differences now is the need to replace the (Rj) gravitational constant (G), and before that it is worth to note what happened for the (global friction) as:

$$\theta = 1 \; and \; R_j = \frac{1}{\sum eMe} = \frac{1}{MW}, and \; F_{ij}^{*} = \frac{M_i M_j}{MW},$$

$\boldsymbol{W}$: $Represent \; the \; countries \; of \; the \; world$

MODAL VARIABLES

Although the Anderson model effectively as mode of gravity, but the researchers and another situation model depends on some variables Anderson model plus the other variables the following are the most important variables

First Economic Quantities: Usually measurement economic quantities of the model (Mi) and (Mj) the size of the gross domestic product (GDP), While noting that the model we are trying through which the estimation equation of gravity be the result of predicting the reactions of foreign trade equal one, here we need the interpretation to the interactions of more than or less than one, in addition to that there is another problem resulting from the inclusion (Log Mi) and (Log Mj) in the form, the first being the tendency to inflate the value of (R2) and this makes it difficult to imagine a world with big countries do not practice trade more of the conditions of absolute, **Second:** the fact that exports and imports are part of the gross domestic product (GDP) and this leads to build Mathematical relationships between the (Fij) and the (Mi) and the (Mj), some of the studies have tried to dealing with this problem by using variables help of the gross domestic product (such as population).

Second Distance: in the past and by the availability of accurate statistics for the distances between cities, primitive methods were used to get those distances (such as scale), then use the following equation to calculate the distance between two states:

$$D_{ij} = 3962.6 \arccos\left[\{\sin(y_i) * \sin(y_j)\} + \{\cos s(y_i) * \cos s(y_j) * \cos s(x_i - x_j)\}\right]$$

As

X: Longitude, multiplied by (57.3) to convert it to the radial angle.

Y: Latitude multiplied by (57.3).

At the present time has become available on the Internet (the Internet) many locations to measure the distances between cities in the world accurately in miles or kilometers, and if the researcher could not get it can be extracted through the program (Google Earth).

At the present time has become available on the Internet many locations to measure the distances between cities in the world accurately in miles or kilometers, and if he could not researcher obtained can be extracted through the program (Google Earth), which allows calculating distances between cities accurately.

And the issue of whether the State is surrounded by land or have a port sea of great importance in calculating the costs of trade For example, in 1995 the percentage of participation of States, landlocked in the global GDP is 11%, compared with countries that have landlocked by 28%, was reflected also on the costs of trade per kilometer between the two groups of states above, (Limao & Venables 2001) estimates the cost per kilometer of the States, landlocked about (3450) dollars, and about (4620) dollars per kilometer for countries that have access to the sea, and for each additional 1000 km by sea is added $ 190, while $ 1,380 is added for each1000 km of additional land, noting that transportation costs increase at a rate (0.94%).

Third the Constant: assume most of the studies to (α) is fairly constant among all countries, so it became a problem for the regression equation, but it is important because it measures the alternatives group import, as the countries where the raw materials used in production of goods close (with a lower value for (R2))will import a smaller quantity of goods from other countries.

With reference to the few studies to Considered (Rj) variable indicated by the (Remoteness) users to get value from the following equation: $R_j = \frac{\sum_e D_{ej}}{M_e}$

This method led to inflate the size of (Rj) being included distance (Dej) and the other side dwarf the value of (Me) and the like make the countries are not related to economic relations as strong as is the case, so we will consider in this study the (Rj) fixed Like a lot of studies that estimated the gravity model.

Fourth Other Factors: As already indicated, the simplified form of gravity model shows the flow of foreign trade between two countries based on GDP and the distance between them, but there are many other factors that affect this flow, including the following:

- **Per Capita Income:** Estimated some studies gravity equation by taking the logarithm of per capita income in the target countries, as well as to include the logarithm of aggregate income for both countries, and this may lead to the problem in the results will appear as the income of these countries will be greater than the income of natural, and the inclusion per capita income in the equation of gravity was a group of the most important reasons that the level of infrastructure in the States developed, where the per capita income is high, such as (roads, airports, ports, etc....) is superior to what exists in developing countries, and thus, these countries are usually Mattered tariffs are low, which is reflected in the services to be provided by more development, and leads to the low ratio of

trade to GDP, and this is reflected in the estimate of the transaction log GDP that appear of great importance in applied studies, which usually ranges between (0.2) and the one.

- **The Neighboring:** The neighbors, or adjacent to or participate in the common border between the two countries has been a problem for some researchers in the form of gravity, as confirmed by some as the Best of importance as long as the researcher takes into account the distance between the two countries, but others indicate that neighboring got rid of the problem that distance may give exaggerated the effect.
- **A Common Language:** Leads the common language a major role in the development of trade relations between countries, has confirmed some of the studies that countries that share the same language to be its trade relations is two sizes larger or more of the countries that haven't the same language, although the similarity of other variables such as GDP and the distance between them.
- **The Colonial Relationships:** Lead the colonial past an important role in the strength of relations between countries, although there are exceptions, the fact that the state (i) the colony by the state (j), this leads to lower its tendency to import them and a preference for imports from other countries may not have the same features state (j).
- **Commercial Agreements:** They commercial agreements a major role in trade flows between countries, and here you must take models of gravity into account this factor as a factor influencing, inflows commercial interfaces between the countries of the EU is a heavy load in the volume of trade flows to these countries as a result of association with the Convention on the European Union, compared with non-entering the EU, as well as the case of trade flows for countries acceding to the Convention on free Trade for the North America (NAFTA).

MODEL FORMULATION

Can formulate the general framework of gravity model, which we will estimate which of the foreign trade flows between the U.S. and selected countries are as follows:

$$\left(1 + X_{ij}t\right)^{*} = \alpha + \beta_1 Y_i t + \beta_2 Y_j t + B_3\, Poi + B_4 Poj + B_5 Pci + B_6 Pcj + B_7 D_{ij} + B_8 \grave{\beta}_{ij} + E_{ij}t$$

$X_{ij}t$: Export size from country (i) to the country (j) in year (t).

$Y_i t$: Country income (GDP) (i) in year (t) which estimated in billion dollars.

$Y_j t$: Country income (GDP) (j) in year (t) which estimated in billion dollars.

Poi: $The\ population\ of\ country\ (i)$

Poj: $The\ population\ of\ country\ (j)$

Pci: $Per\ capita\ incom\ for\ country\ (i)$

Pcj: $Per\ capita\ incom\ for\ country\ (j)$

D_{ij}: The distance between country (i) and country (j) which estimated in kilometer?

$\grave{\beta}_{ij}$: Dummy variable which includes all other factors that occur between the two countries (i) and (j).as well as we use the o-1 dummy variable

E_{ij}**:** Random variable (Error).

As well as we take the exponential function formula after another that turned into a linear and then using algorithms that can be estimated in ordinary least squares method (OLS) Will we are adoption of the three countries are Canada, the United Kingdom and China as the best commercial partners of the United States of America, and took the data of these countries from the U.S. Census Bureau and the World Bank and was placed in Appendix.

ANALYSIS AND CONCLUSIONS

Estimated formula of linear and exponential logarithmic transformation of the three different kinds of formula a double logarithmic and inverse logarithmic formula and the formula for semi-logarithmic and then choose the equation is the best estimate that has passed all statistical and Econometric tests Organized in the table of estimates for each country, as follows:

Estimate the Gravity Model of the United States with Canada

When appreciation appeared econometrics problems caused by some variables and no abnormal values in the data was deleted from the model and delete anomalous values of data, we are estimated linear model and exponential logarithmic transformation, which we have referred to previously organized in the following table:

Table 1: Show the Estimation of Gravity Models for Trade between USA and Canada

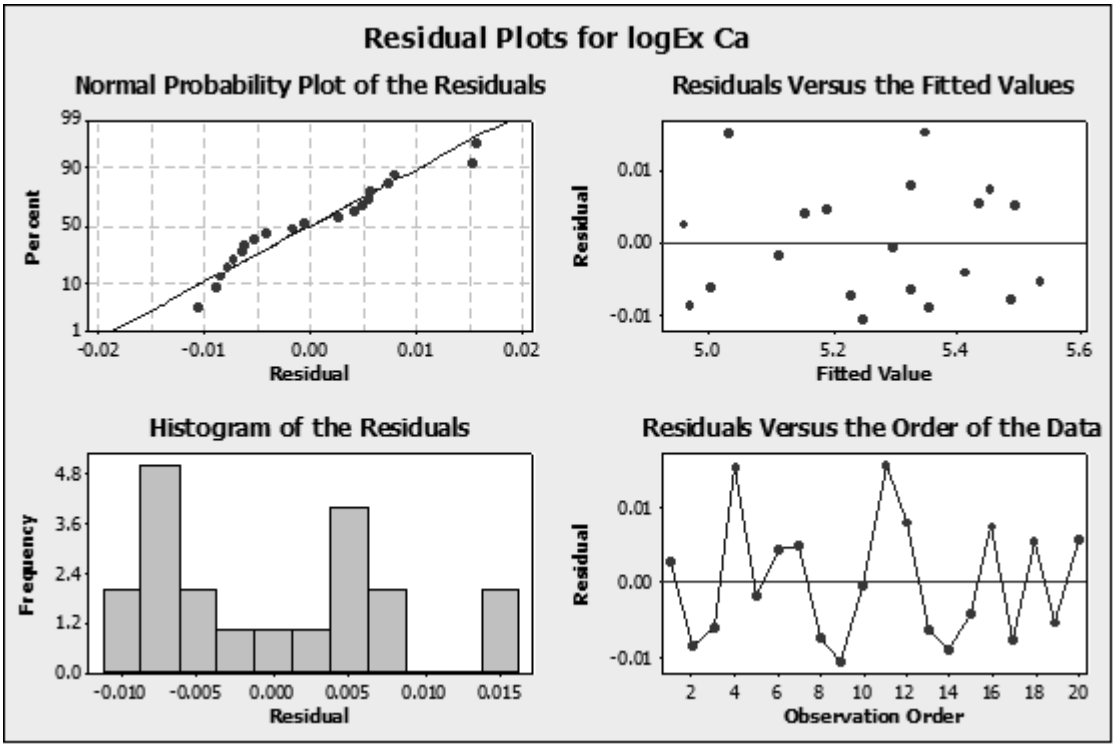
Models / Parameter's	Linear	Power Equation Log-Log	Power Equation Log- Linear	Power Equation Semi- Log
Constant t	-823649 $(-0.16)^{non}$	90.40 $(7.05)^{1\%}$	-5.18 $(-0.37)^{non}$	27667512 $(4.96)^{1\%}$
USA POP t	10260 $(0.58)^{non}$	-66.50 $(-5.71)^{1\%}$	0.01708 $(0.36)^{non}$	-15188516 $(-3.00)^{1\%}$
Canada POP t	-49412 $(-0.30)^{non}$	2.862 $(0.46)^{non}$	0.2694 $(0.60)^{non}$	-6958325 $(-2.57)^{5\%}$
USA GDP t	87.68 $(2.44)^{5\%}$	2.6813 $(3.02)^{1\%}$	0.000143 $(1.47)^{10\%}$	2411510 $(6.24)^{1\%}$
Canada GDP t	-75.7 $(-0.62)^{non}$	0.3302 $(1.83)^{5\%}$	-0.00031 $(-0.95)^{25\%}$	212504 $(2.71)^{1\%}$
Canada Dc t	-228.3 $(-0.49)^{non}$	14.574 $(6.11)^{1\%}$	-0.0010 $(-0.81)^{25\%}$	3736381 $(3.60)^{1\%}$
USA Per capita t	5.30 $(0.30)^{non}$	-0.487 $(-0.36)^{non}$	0.0000423 $1.15^{25\%}$	-1791619 $(-3.01)^{1\%}$
Canada Per capita T	-9.553 $(-1.02)^{25\%}$	2.4333 $(3.22)^{1\%}$	-0.000026 $(-1.03)^{25\%}$	987095 $(3.01)^{1\%}$
Se	10102.4	0.0101068	0.0272759	4396.23
R^2	98.9%	99.8%	98.6%	99.8%
$\bar{R}^2$	98.3%	99.7%	97.8%	99.7%
R	99.4	99.9%	99.3%	99.9%
F(8,20)	$161.43^{1\%}$	$893.51^{1\%}$	$121.2^{1\%}$	$859.78^{1\%}$
D.w	$1.8267^{1\%}$	$2.06781^{1\%}$	$1.5273^{1\%}$	$2.26588^{5\%}$

Source: The result by using Minitab 14.1 program

$$t_{0.25} = 0.695, t_{0.10} = 1.35, t_{0.05} = 1.782, t_{0.01} = 2.681, F_{0.05} = 4.50, F_{0.01} = 8.76$$

$$du = 1.81 < D.W < du = 2.18_{0.05}$$

Evidenced by the appreciation that the best estimate was for linear model conversion logarithmic double, which represents the model exponential The results showed that all of the parameters fixed and the United States population and gross domestic product of the United States and the distance between Canada and the United States and the rate of per capita income significantly on level of significance of 1% using t-test and as well as proven the parameter of variable GDP Canadian level of significance 5% did not prove significant parameters other variables at any level, and based on the F-test proved significant form on the level of significance of 1%, indicating the effectiveness of the variables in the model and the effectiveness of the coefficient of determination multi interpretation change in U.S. exports to Canada of approximately 99%, and that all common points of all the variables with exports very close to the regression line which indicates the strength of the relationship between them, The test showed D.W occurrence calculated value in the region of acceptance and hence there is no problem correlation between self-residue random figure shows the following:



Source: Results of the estimate of using the program Minitab.14.1

Figure 1: Shows the Four Forms of Random Direction Residuum

Seen from Figure first in the top on the right which is named in residuals that all residuals spread well and therefore there is no problem instability homogeneity of variance, either second figure in the top on the left shows that values residuum very close to the regression line, showing that all other variables had interpreted the change in exports to a very large, either figure below on the right shows there is no problem autocorrelation between residuals random as collect form both types of correlation and thus negated the existence of any correlation self and finally form below to the left, it is the arithmetic mean of the random variable equal to zero and thus does not violate any of the assumptions besides those random shapes and form has thus passed all econometric statistical tests and thus be a good model gravity to represent the economic relationship.

It is clear from individual relationships between the independent variables and the dependent variable that all of the variables the population of Canada and GDP to the U.S., Canada and the per capita income Canadian its relationship

positive with exports United States can be explained as the positive relationship between exports and U.S. population consistent with hypotheses economic theories well as compatible with U.S. gross domestic product, but contrary to the logic of the theoretical relationship GDP Canadian exports from the United States and justify the appearance of this positive relationship to the fact that there are trade agreements between the United States and Canada and therefore exports to Canada goes against which imports very large, which shows positive output Canadian and rate of per capita income and in turn increase gross domestic U.S. relationship positive while showed estimate negative per capita income U.S. may be justified researchers these negative because exports relationship positive with GDP but in turn influenced by imports, either variable distance showed relationship positive with exports and this abuse with logic theoretical and which must be negative relationship and researchers justify this positive because the data.

Estimate the Gravity Model of the United States with United Kingdom

By the same way we are estimated the gravity model for United States and United Kingdom and arrangement in the following table:

Table 2: Show the Estimation of Gravity Models for Trade between USA and United Kingdom

Models / Parameter's	Linear	Power Equation Log-Log	Power Equation Log- Linear	Power Equation Semi- Log
Constant t	-1457113 $(-3.84)^{1\%}$	25.134 $(3.49)^{1\%}$	-12.025 $(-1.56)^{10\%}$	1825250 $(3.82)^{1\%}$
USA POP t	4377 $(3.52)^{1\%}$	-36.197 $(-6.34)^{1\%}$	0.04881 $(1.93)^{5\%}$	-2436783 $(-6.43)^{1\%}$
United Kingdom POP t	9672 $(2.86)^{1\%}$	2.975 $(2.14)^{5\%}$	0.09807 $(1.43)^{10\%}$	187261 $(2.03)^{5\%}$
USA GDP t	2.483 $(0.78)^{25\%}$	1.6681 $(1.95)^{5\%}$	-0.000025 $(-0.39)^{non}$	268652 $(4.73)^{1\%}$
United Kingdom GDP t	3.085 $(1.06)^{25\%}$	-0.1529 $(-1.50)^{10\%}$	0.000036 $(0.61)^{non}$	-6447 $(-0.95)^{25\%}$
United Kingdom Dc t	-9.729 $(-3.75)^{1\%}$	7.254 $(5.27)^{1\%}$	-0.000093 $(-1.76)^{10\%}$	330765 $(3.62)^{1\%}$
USA Per capita t	3.5366 $(3.55)^{1\%}$	3.1775 $(3.27)^{1\%}$	0.00005695 $(2.81)^{1\%}$	145893 $(2.26)^{5\%}$
United Kingdom Per capita t	-1.715 $(-1.67)^{10\%}$	0.3546 $(0.69)^{25\%}$	-0.000038 $(-1.80)^{5\%}$	37912 $(1.11)^{25\%}$
Se	1006.07	0.00968361	0.0204693	642.669
R^2	99.6%	99.8%	99.0%	99.8%
$\bar{R}^2$	99.4%	99.6%	98.4%	99.7%
R	99.9%	99.9%	99.5%	99.9%
F(8,20)	$444.82^{1\%}$	$758.44^{1\%}$	$168.41^{1\%}$	$1092.57^{1\%}$
D.w	$1.15494^{5\%}$	$2.14160^{5\%}$	$0.935079^{5\%}$	$2.58676^{5\%}$

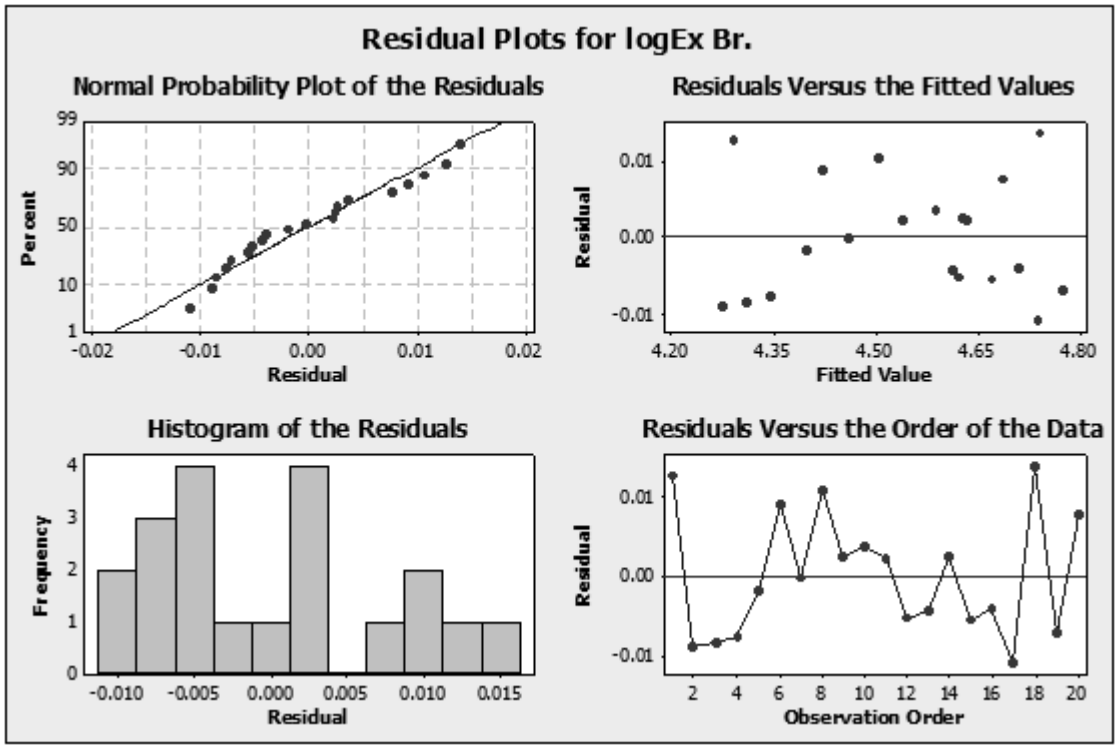
Source: The result by using Minitab 14.1 program

t_0.25=0.695, t_0.10=1.35, t_0.05=1.782, t_0.01=2.681, F_0.05=4.50, F_0.01=8.76

〖4-du=2.18 <D.W<4-dl=3.304〗 _0.05

Chosen form similarities logarithmic as the best model of gravity between the United States and the United Kingdom is not for being passed statistical tests and Econometric but were parameter variables mostly compatible with hypotheses of economic theory and based on the t-test proved significant both parameters fixed and variable of population United States and GDP States and the cost of transport at the level of significance of 1%, while proven parameter variables

of population of the United Kingdom and the U.S. per capita income on the level of significance of 5% and 25% level proved significant parameter variables British GDP and per capita income. Based on the F-test proved significant form on the level of significance of 1% show the efficiency of the model in the representation of the economic relationship, and showed parameter's ability to explain the change in U.S. exports to the United Kingdom by 99% and remaining back to other factors did not enter the model and the correlation coefficient total has reached the proportion high which indicates the strength of the correlation between the independent variables and the dependent variable, and showed appreciation and occurrence of the calculated value in the crucial decision of others or similarities uncertain based test D.W can ascribe this estimate as the following chart:



Source: Results of the estimate of using the program Minitab.14.1

Figure 2: Shows the Four Forms of Random Direction Residuum

Seen from Figure in the top on the right spread of residuals on about line zero, which corresponds to the hypothesis of a random variable and excludes the existence of the problem of multiy collinearity between independent variables, either form in the same direction at the bottom show the movement of residuals with the dependent variable and shows that the direction of residuals is excludes the existence of the problem of autocorrelation between residues values and proven the results of the estimated, the figure shows the left hand that the residuals very close to the regression line, which demonstrates the power of appreciation.

Showed assigns of the parameters variables in line with assumptions of economic theory in its entirety and the other was contrary to the logic of economic as appeared variable population U.S. negative relationship with exports, and it raised ASK has two faces, as the passivity means declining exports due to increased demand for goods at home and positively mean increased employment producing goods and thus increase exports and these possibilities are in the economic relations can be justified according to economic theory.

The variables population British and the USA, UK GDP and transportation costs and per capita income U.S. in line with the assumptions of economic theory relationship with exports, while showed parameter variable rate of per capita income British violating the hypotheses theory because positive relationship with exports and justify researchers having values abnormal led to the emergence this positive economic relationship.

Estimate the Gravity Model of the United States with China

By the same way we are estimated the gravity model for United States and China and arrangement in the following table:

Table 3: Show the Estimation of Gravity Models for Trade between USA and China

Models / Parameter's	Linear	Power Equation Log-Log	Power Equation Log- Linear	Power Equation Semi- Log
Constant t	-16102 $(-0.03)^{non}$	-48.52 $(-1.92)^{5\%}$	-5.918 $(-2.51)^{10\%}$	17253525 $(3.48)^{1\%}$
USA POP t	5422 $(1.64)^{10\%}$	1.610 $(0.19)^{non}$	0.01763 $(1.06)^{25\%}$	5359848 $(3.22)^{1\%}$
China POP t	-906.6 $(-2.18)^{5\%}$	24.057 $(2.43)^{5\%}$	0.006740 $(3.23)^{1\%}$	-8480037 $(-4.37)^{1\%}$
USA GDP t	62.4 20 $(7.03)^{1\%}$	4.836 $(2.25)^{5\%}$	0.000132 $(2.96)^{1\%}$	2049811 $(4.85)^{1\%}$
China GDP t	-26.708 $(-3.37)^{1\%}$	-0.6209 $(-2.72)^{1\%}$	-0.000094 $(-2.35)^{5\%}$	-47397 $(-1.06)^{25\%}$
China Dc t	-6.935 $(-3.40)^{1\%}$	-5.347 $(-1.93)^{5\%}$	-0.000027 $(-2.58)^{5\%}$	-1458101 $(-2.67)^{1\%}$
USA Per capita t	-10.397 $(-3.56)^{1\%}$	-4.136 $(-1.87)^{5\%}$	-0.000044 $(-3.00)^{1\%}$	-1364274 $(-3.14)^{1\%}$
China Per capita t	37.815 $(3.86)^{1\%}$	0.8074 $(0.96)^{25\%}$	0.000047 $(0.95)^{25\%}$	400726 $(2.41)^{5\%}$
Se	3861.30	0.0251718	0.0194239	4944.26
R^2	99.9%	99.8%	99.9%	99.9%
$\bar{R}^2$	99.8%	99.7%	99.8%	99.8%
r	99.9%	99.9%	99.9%	99.9%
F(8,20)	$2462.27^{1\%}$	$789.91^{1\%}$	$1327.74^{1\%}$	$1501.09^{1\%}$
D.w	$2.45208^{5\%}$	$2.04017^{5\%}$	2.47103	$2.23531^{5\%}$

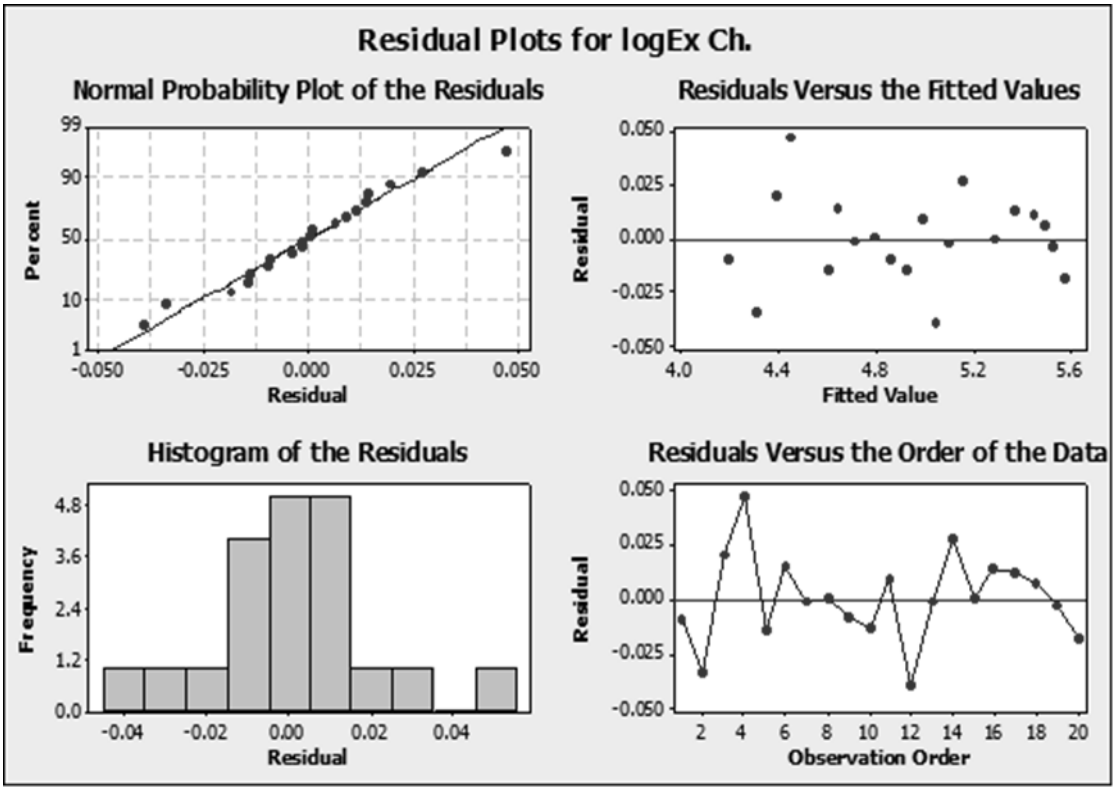
Source: The result by using Minitab 14.1 program

t_0.25=0.695, t_0.10=1.35, t_0.05=1.782, t_0.01=2.681, F_0.05=4.50, F_0.01=8.76

〖4-du=2.18 <D.W<4-dl=3.304〗 _0.05

We chose the semi logarithmic model as the best model of gravity between the United States and China is not for being has passed all statistical and econometrics testes, but it corresponds to the logic of hypotheses economic theory and based on the t-test shows significant parameters variables U.S. population and the population of China and U.S. gross domestic product and transportation costs and per capita income U.S. on level of significance 1% and the level of significance 5% significant parameter per capita income of China, and the level of significance 25% significant parameter Chinese GDP, and showed the form efficiency in the representation of the economic relationship and ability explanatory as it was significant at level of significance 1% based on the test F. showed Figure 3 diagrams ability to pass four econometric tests of gravity model chosen.

Explain estimate agree variables population of the USA and U. S. gross domestic product and gross domestic Chinese with hypotheses theory while showed China's population negative relationship with exports as the increase in population leads to decreased U.S. exports and this deal with China's ability to absorb Chinese labor increased in the production of goods imported by which reduces imports and consequently less U.S. exports have but show trade restrictions within the World Trade Organization and facilities enjoyed by China ability to move trade including back in the benefit of the Chinese economy and the per capita income of China relationship positive with exports and this enhances say that increase population claim to reduce imports and increase domestic production, which leads to increased GDP and thus increase the rate of per capita income, while showed transport costs passivity with exports as the increased claim to a decline in U.S. exports to China or to a decline in Chinese imports from America this may be related to the lifting of restrictions marine Insurance and therefore it is compatible with economic theory.



Source: Results of the estimate of using the program Minitab.14.1

Figure 3: Shows the Four Forms of Random Direction Residuum

Through analysis and estimated shows us that the most powerful gravity model between the United States and the sample was a model of gravity between China and United States and this is due to the conditions trading that govern the relationship between China and the U.S. by bilateral agreements or under agreements GATT and then comes the United Kingdom and finally Canada in spite, although the transportation costs vary between countries because the transportation costs between China and the United States due to shipping costs which the longest distance between them while from U.S.A and UK, this shows that the Chinese economy has the ability to absorb changes in the global markets and high flexibility in covering all the needs of global goods and equipment capital and technical cheaper prices than those produced in Europe or America, and with the same quality, making China the biggest economic competitor to many countries of the world in the markets of developing countries than U.S. or European markets.

CONCLUSIONS

- Show of models that estimate the gravity model between the United States and China was one of the best models in recognition and comes then respectively the United Kingdom and then Canada.
- U.S. exports to China face different restrictions do it Chinese law. Contrast that the U.S. began to impose strict restrictions direction of trade with China.
- Started in the United States to promote exports to the world restrictions easier than it was previously.

RECOMMENDATIONS

- As the foreign trade sector influential in national income should boost exports and reduce imports.
- Easy that occupies China where much of the world in the international market, especially developing countries and wishing goods cheap and this the UNA don't be controlled of its because of the high costs of labor and raw materials authentic and it should U.S. increase Foreign trade by finding a new outlets in Asia or Africa because the labors and production costs are low and commodity-quality larger than those of the product in the world and pursue a policy of flooding the markets with the support of American companies.

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APPENDICES

Table 4: Shows the Exports and Imports of the United States and Selected Countries Period (1990 - 2011) (Million Dollars)

Years	Canada		United Kingdom		China	
	Imports	Exports	Imports	Exports	Imports	Exports
1990	91,380.1	83,673.8	20,188.3	23,490.5	15237.4	4806.4
1991	91,063.9	85,149.8	18,412.9	22,045.7	18969.2	6278.2
1992	98,629.8	90,594.3	20,093.2	22,799.9	25727.5	7418.5
1993	111,216.4	100,444.2	21,730.3	26,438.2	31539.9	8762.9
1994	128,405.9	114,438.6	25,057.4	26,899.5	38786.8	9281.7
1995	144,369.9	127,226.0	26,929.7	28,856.5	45543.2	11753.7
1996	155,892.6	134,210.2	28,978.7	30,962.3	51512.8	11992.6
1997	167,234.1	151,766.7	32,659.2	36,425.3	62557.7	12862.2
1998	173,256.0	156,603.5	34,838.3	39,058.1	71168.6	14241.2
1999	198,711.1	166,600.0	39,237.3	38,407.2	81788.2	13111.1
2000	230,838.3	178,940.9	43,345.1	41,570.6	100018.2	16185.2
2001	216,267.9	163,424.1	41,368.7	40,714.2	102278.4	19182.3
2002	209,087.7	160,922.7	40,744.9	33,204.7	125192.6	22127.7
2003	221,594.7	169,923.7	42,795.0	33,827.9	152436.1	28367.94
2004	256,359.8	189,879.9	46,273.8	36,000.2	196682.03	34427.77
2005	290,384.3	211,898.7	51,032.6	38,587.8	243470.1	41192.01
2006	302,437.9	230,656.0	53,513.0	45,410.1	287774.35	53673.01
2007	317,056.8	248,903.9	56,892.9	50,296.2	321442.87	62936.9
2008	339,491.4	261,149.8	58,587.38	53,599.07	337772.63	69732.84
2009	226,248.4	204,658.0	47,479.89	45,703.6	296373.88	69496.68
2010	277,647.5	249,105.0	49,775.04	48,413.54	364943.85	91880.61
2011	315,346.5	280,889.6	51,236.09	55,880.72	399361.92	103939.43

Source: The researchers setting from
U.S Census Bureau: Foreign Trade Statistics

Table 5: Shows the Population of USA and Selected Countries Period 1990-2011 (Million Persons)

Years	USA	Canada	United Kingdom	China
1990	250.047	27.639	57.237	1,143.330
1991	253.392	27.988	57.439	1,158.230
1992	256.777	28.319	57.585	1,171.710
1993	260.146	28.648	57.714	1,185.170
1994	263.325	28.958	57.862	1,198.500
1995	266.458	29.263	58.025	1,211.210
1996	269.581	29.571	58.164	1,223.890
1997	272.822	29.869	58.314	1,236.260
1998	276.022	30.126	58.475	1,247.610
1999	279.195	30.370	58.684	1,257.860
2000	282.332	30.651	58.886	1,267.430
2001	285.365	30.974	59.113	1,276.270
2002	288.331	31.323	59.322	1,284.530

Table 5: Contd.,

2003	291.194	31.633	59.554	1,292.270
2004	293.978	31.947	59.834	1,299.880
2005	296.852	32.258	60.218	1,307.560
2006	299.715	32.581	60.533	1,314.098
2007	302.546	32.908	60.836	1,320.668
2008	304.718	33.263	61.798	1,328.020
2009	307.374	33.669	61.798	1,334.740
2010	309.997	34.059	62.222	1,341.414
2011	312.891	34.384	62.644	1,348.121

Source: The researchers setting from
U.S Census Bureau: Foreign Trade Statistics

Table 6: Shows the GDP for Countries Sample Period 1990-2011 (Billion Dollars)

Years	USA	Canada	United Kingdom	China
1990	5,803.075	582.805	1,001.023	387.772
1991	5,995.925	598.239	1,043.465	406.090
1992	6,337.750	579.978	1,085.402	483.047
1993	6,657.400	563.940	969.554	613.223
1994	7,072.225	564.608	1,047.720	559.225
1995	7,397.650	590.650	1,141.358	727.946
1996	7,816.825	613.808	1,200.830	856.002
1997	8,304.325	637.671	1,336.164	952.649
1998	8,746.975	617.434	1,433.972	1,019.481
1999	9,268.425	661.345	1,475.731	1,083.285
2000	9,816.975	725.158	1,453.840	1,198.478
2001	10,127.950	715.632	1,444.712	1,324.814
2002	10,469.600	734.773	1,585.018	1,453.833
2003	10,960.750	868.319	1,827.630	1,640.963
2004	11,685.925	993.938	2,169.393	1,931.646
2005	12,433.925	1,135.454	2,246.331	2,243.687
2006	13,194.700	1,275.283	2,398.946	2,644.642
2007	13,794.221	1,406.430	2,755.920	3,248.522
2008	14,291.550	1,502.678	2,679.013	4,519.950
2009	13,938.925	1,528.985	2,182.430	4,990.528
2010	14,526.550	1,624.608	2,250.209	5,878.257
2011	15,064.816	1,708.100	2,480.034	6,988.470

Source: The researchers setting from:
U.S Census Bureau: Foreign Trade Statistics

Table 7: Shows the Distance between USA and Countries Sample (Kilometer)

Country	The Distance between USA and Countries Sample
Canada	788
United Kingdom	5915
China	11172

Source: http://www.timeanddate.com/worldclock/distance.html

Table 8: Shows the Transportation Cost between USA and Countries Sample Period 1990-2011 (US Dollar)

Years	Canada	United Kingdom	China
1990	2781.6	28277.3	53314.64
1991	2948.469	29973.938	56513.518
1992	3115.365	31670.576	59712.396
1993	3282.261	33367.214	62911.274
1994	3449.157	35063.852	66110.152
1995	3616.053	36760.49	69309.03
1996	3783.093	38457.128	72507.908
1997	3949.935	40153.766	75706.786
1998	4116.831	41850.404	78905.664
1999	4283.727	43547.042	82104.542
2000	4450.623	45243.68	85303.42
2001	4617.519	46940.318	88502.298
2002	4784.415	48636.956	91701.078
2003	4951.311	50333.594	94899.956
2004	5118.207	52030.232	95219.736
2005	5285.103	53726.87	98418.614
2006	5451.999	55423.508	101617.492
2007	5618.895	57120.146	104816.37
2008	5785.791	58816.784	108015.248
2009	5952.687	60513.422	111214.126
2010	6119.583	62210.06	114413.004
2011	6286.479	63906.698	117611

Source:

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