Master Thesis

Gravity approach to the determinants of Pakistan's export: A panel analysis of the gravity model

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The Graduate School of Hansung University

Major in International Market Analysis

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Abstract

Gravity approach to the determinants of Pakistan's export: A panel analysis of the gravity model

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The purpose of this research is to identify various economic factor which effects Pakistan export. Over a 15-year period, from 2015 to 2019, a comprehensive data set was created and used to evaluate the panel gravity model of Pakistani export streams to a major trade partner. In the first stage a simple regression or OLS estimation is performed for the panel data. In the second step fixed effect model is tested and the last step we applied the random effect model. Then we estimate the Hausman test to choose the model between fixed effect and random effect. By utilizing the Hausman test it suggest us to choose the random

effect model rather than fixed effect model. In the next step we performed one another test which is called LM test this test is used to choose between random effect model and OLS model. This test suggest us that random effect model is better than simple OLS. Data selected for the thesis is strongly balanced. The variable used to find its effect on Pakistan include, GDP of Pakistan and host country, distance between them, remoteness variable, GDP per capita of partner country, effect of SAARC on Pakistan exports. All the three model show that GDP and remoteness show positive and distance show negative effect, higher the GDP of exporting and trading partner higher will be the export, closer the distance from the exporting nation higher will be the trade between them. The variable of GDP per capita show negative while the SAARC show positive effect on Pakistan export.

Key words: Gravity model, panel regression, Random effect model, Fixed effect model, SAARC, Trade value of Pakistan.

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Abbreviation

FEM = Fixed Effect Model

REM = Random Effect Model

PGDP = Product of Gross Domestic Product

TER = Terrorism

EPH = Electricity Production from Hydro Source

SAARC = South Asia Association for Regional Coorperation

CHAPTER 1: INTRODUCTION

1. INTRODUCTION

The gravity model is used in this research to analyze the export performance of Pakistan with its major trading partner. From few decades gravity model is used for international trade and its focused on that trade between countries is based on GDP and distance same like Newton law of gravitational force. According to gravity model of international trade the trade between two countries is directly related to the masses of their GDP and inversely related to the distance between the trading countries. Unlike other devoleped countries Pakistan exports to a few countries. Pakistan export mainly textile, apparel, footwear, agriculture product, meat, diary and seafood. Pakistan have a comparative advantages over these product, although Pakistan also export mineral, metals, machineries and electrics but the country have no comparative advantages over these product.

Pakistan top exports country are USA, China, England, UAE, Saudi Arabia, India, Bangladesh, Afghanistan, Turkey, France, Germany, Korea, Italy, Sri Lanka, Australia, Spain, Netherland etc. USA being the largest trading partner of Pakistan followed by china, UK , and Germany. In 2019 Pakistan's export's share is 16.97% China share is 8.58%, United Kingdom 7.06%, Germany 5.65%(world bank).

The European union and united states are largest trading partners, accounting for 25% and 20% shares of Pakistan respectively. Other major importers include china, Dubai and Saudi Arabia. Major exports are in garments made-ups and bed wear, each of which is valued at US$1.35

billion. Knitwear, ready made garments and cotton yarn also have important export shares(World bank 2006, 32).

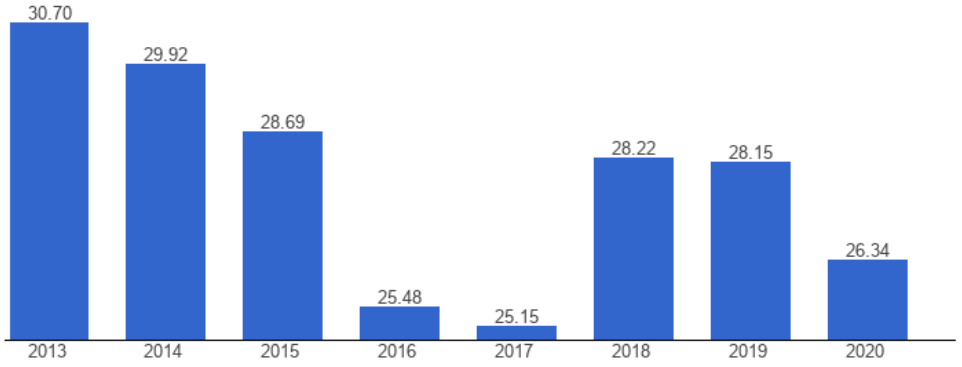
China is consider one of the emerging export market for Pakistan as Pakistani export fastly rise from $2.2 billion in 2005 to $15.6 in 2019. In 2009, Pakistan also signed an agreement with china to use Chinese currency to get rid of the dollar burden in $15 billion bilateral trade, Pakistan is already enjoying zero duties on export of 724 products to china under the first free trade fact signed between the two countries in 2006 (islamuddin sajid, 2021).

Pakistan has been now allowed to export more than 1000 product after the implementation of second pact. Pakistan and china also signed a mega project CPEC worth around $64 billion, largest foreign direct investment in the history of Pakistan, CPEC(China Pakistan economic corridor) is one of the major pilot project of belt and road initiative of china. The framework will "promote industrialization and development of economic zones, and initiate, plan, execute, and monitor projects both in public as well as private sector"(invest.gov.pk).

Pakistan also exports to its neighboring countries such as India, Afghanistan and SAARC nation as Pakistan is also a member of SAARC nation but the export of Pakistan to its neighboring countries is less then one percent. India one of the big economy like china and US shared bordered with Pakistan but the trade between India and Pakistan is low because of dispute territory Kashmir. Being a member of SAARC(South Asian Association for Regional Cooperation) Pakistan signed a free trade agreement with SAARC nation. The SAARC nation include Pakistan, India, Afghanistan, Sri Lanka, Nepal, Bhutan, Bangladesh, Maldives.

In SAARC The major export partner of Pakistan is Afghanistan

Figure 1: Pakistan export value in billion US Dollars



Source: The Global Economy

Figure 1 show the exports value of goods and service from 2013 to 2020. The export value is highest in year 2013 which is 30.70 billion dollars and lowest at 2017 which is 25.15 billion dollars. The figure show irregular trend of Pakistan exports, this is because of uncertain political situation through out the history of Pakistan. Major exports of Pakistan is knitwear, readymade garments, Football, footwear, leather goods, cutlery.

Pakistan signed a free trade agreement with various nation in order to boom their export. Some of the free trade agreement are listed in the table.

TABLE 1: BILATERAL TRADE AGREEMENTS

	BILATERAL TRADE AGREEMENTS	**JOINING**
1	South Asian free trade Area (SAFTA)	2004
2	Pakistan-Sri Lanka free trade agreement	2005
3	Pakistan China free trade agreement	2006
4	Pakistan-Malaysia free trade agreement	2007
5	Pakistan-Mauritius free trade agreement	2007

Source: ministry of trade and commerce, Government of Pakistan.

CHAPTER 2: LITERATURE REVIEW

2. LITERATURE REVIEW

The gravity model was first presented by Tinbergen(1962). The idea for the gravity model of international trade was same as Newton law of gravitational force, which state that "gravity force is directly related to the masses of the body and inversely to the distance between them. In the gravity model of international trade the masses is related to the GDP of both trade partner and the distance between the trade partner.

Gravity Model Equation:

$$Tij = \frac{GDPi * GDPj}{Dij}$$

Tij : indicates trade between country i and country j
GDPi: GDP of the export country
GDPj: GDP of the import country

Initially Anderson did not provide any theoretical foundation for the gravity model of international trade as Newton provide for the law of gravitational force, later the work on some scientist Linnemann (1966), Anderson (1979), Bergstrand (1989), Dearddorff (1998), Anderson &

Wincoop (2003) and Guttman & Richards(2004) provides the basis for theoretical foundation.

Gul & Yasin, (2010) used the gravity model to find the trade potential of Pakistan. Panel data were used on 42 countries for the period 1981-2005 are being analyzed. The coefficients derived from the model then are utilized both in the world and within particular trading regions to check the trade potential of the nation. The outcomes suggest that Pakistan have the highest potential of trade with the European countries, the Asia-Pacific region, ASEAN(The Association of Southeast Asian nations), the Middle East, North America and Latin America. Specifically, maximum potential exist with Bangladesh, Japan, Malaysia, Sri Lanka, New Zealand, Phillippines, Swedan, Norway, Denmark, and Italy. Pakistan should also discuss ways and means of further improvings its trading ties with the countries involved and also concentrating on ASEAN , The Middle East and the EU In order as much as possible to expands its market share. Despite considerable potential , the amount of trade between Pakistan and other countries of the SAARC states and the organization of economic cooperation (ECO) is very low. The social and political pressure between neighboring countries , particular between India and Pakistan, the key player of the SAARC , are the main obstacles. The same barrier remain for NAFTA and for the EU, where the diplomatic consideration of Pakistani exports are adversely overwhelmed.

Bryn Battersby & Robert Ewing (2005) examine how distance and economic size influence the level of international trade. International gravity model parameter are estimated and used to calculate annual expected aggregate trade for Australia for the period of 20 years. In this research paper they examine a new indicator of economics remoteness

that statistically identify each country's distance from world economic activity. They found that Australia performing better than the gravity model predict given its geographic remotnness.

Javed Iqbal (2016) used the gravity model in his research to find the effect of some economic variable on the export performance of Pakistan. He used the gravity model of trade and panel data estimation to find the export trend of Pakistan, the study suggest that pakistan's export showing a decline trend because the export of Pakistan not only concentrated to a few goods but also exporting to a few countries.

The analysis also found that both GDP and GDP per capita of trading partner have significant impact on trade between two countries. Pakistan export are negatively related to the distance variable. The research also found that sharing a boarder was not found significant for pakistan's export, the main reason was despite over territory and terrorism related incident with india and Afghanistan.

Khan (2000) used the gravity model to investigate the link between bilateral trade in Pakistan and economic, culture and geographic variable. The depend variable is volume trade that is the value of both import and export of 10 key commodities. The independent variable include, real tariffs, exchange rate, GDP product, distance, GDP per capita, Boardering countries, official language(English) and dummies to represent SAARC, ASEAN, EU and NAFTA. The Model cover 10 commodities and contain 21 nation with data from 1985 to 1994. Except for the variable for boarder or neighboring all other variable are find extremly significant. This can be link to the Pakistan and India conflict over a dispute territory Kashmir.

M. M. Rahman (2006) measured the gravity model for the trade volume(import and export). Rahman examines various variable GDP(economy size) per capita GNP, exchange rate, openness of Bangladesh economy. All the factor show positive impact on Bangladesh exports while exchange rate show no impact on Bangladesh import, the import effect are determined by inflation rate. There is an inverse relationship between transportation cost and Bangladesh's trade. Import of Bangladesh is also found to be affected by its neighboring countries, Bangladesh have the capacity to do more trade with its boarder nations, as the country particular result indicated. Bangladesh trade and exports have a positive impact on multilateral resistance factors.

Mohammad Mafizur Rahman, (2010) used panel estimation technique to find various factor effect Bangladesh export. The estimated outcomes show that key contributor to Bangladesh export's are the openness of the bangledesh economy, the exchange rate and the partner countries total import demand. All these factor have positive effect over Bangladesh export. Distance or transportation cost have negative effect on Bangladesh export. The results show that a boardering nation have a greater impact over Bangladesh export as a result Bangladesh should lower trade barrier, seek competitive currency depreciation, boost commodity efficiency and extend product range.

Akhter and Ghani , (2010) address the advantage of trade under the SAARC countries free trade agreement. It investigate trade oppurtunaties and the establlisment of trade between member states and non member states. Gravity model was used to determine international trading flow for member and non members countries and assess the trade consequences.the gravity model is evaluating in two consequances. The cross sectional

statistics is focus in the first study for every year and pooled data is used in the second analytical investigation for the measurement of total trade impact and trade flow between 2003 to 2008. The finding from both the model illustrate that the predicted cofficients correspond to the model assumptions. Both analyzes suggest that both the member state and non member states of the SAARC Regional trade agreement can distract the trade. Trade volume will only rise until the key partner (Sri Lanka, India, Pakistan) could a regional trade deal.

Rao Muhammad atif, Liu Haiyun & Haider, (2016). Addressed the importance of agriculture export for developing nations. This study find out the main determinants of agriculture export of Pakistan by using the gravity model over the period of 1995 to 2014 for a sample of 63 countries. The result obtained from this study show the consistency of gravity model for agriculture export of Pakistan. This study find out that exchange rate as well as tariff rates also effect the agriculture export of Pakistan. Common boarder, common culture, colonial history and preferential trading agreement have also significant effect over the agriculture export of Pakistan. The study suggest that Pakistan have a great export potential with neighboring, middle East and European countries.

Maryam Sultan, Kashif Munir, (2015) this paper analyze the export, import and total trade determinants and potential of Pakistan by using the gravity models for the period ranging from 2000 to 2013 across 38 countries. The result obtained from this study shows that export and import determinant are different from that of total trade determinants. This study suggest that Pakistan have a high trade potential with Norway and hungry, as for the exports the highest potential exist with

Switzerland and hungry while for imports the highest potential exist with Philippines, Portugal and Greece. Distance is the proxy of transportation countries sharing boundries with Pakistan offer lower transportation cost due to low distance, Pakistan sharing boarder with two major economies India, China, but only with china Pakistan has exhausted its trade potential.

Prasai (2014) Inspects the Nepal's trade design by utilizing pooled ordinary least square (OLS) Accompanied by one-year gap GDP after economic liberalization, the economy is found structural shift in Nepal.
In this analysis the , a gravity model is used for a large panel data set covering Nepal's 94 trading partner over a 29-year of period.

The outcomes seem robust to sepecification, trade determinants and time period. This analysis distinguish export and import, rather than use the over all turn over of trade , according to sa standered in this area. The analytical are reliable with the simple gravity model as the analysis demonstration positive economic dimension coefficient and negative distance coefficients. In trade determinants after economic liberalization, there is no major systemic split. The finding of stimulation compare real trade with the expected trade show that political decisions as for instance the economic sanctions enforced by other countries do not distort Nepal trade the finding also show that trade with india is very significant as compared to china. The finding show that Nepal wants to diversify trade in general and to profits from trade agreements with china in particular.

The people republic of china and india, which have been exposed by trade strength indexes, have significant bilateral trade prospects. The free trade agreement between these countries are currently being negotiated

based on their complementries. This study attempt to quantify the potential advantages of both Indain and Chinese import profit or losses as a result of various preferential exchange agreements and FTAs in the gravity model. Empirical findings suggest that India possible advantage on a short-term basis, owing to its high tariffs is comparatively smaller than that of china. India profit in the long term though, are more than china when its tariffs level match. Free trade agreement are a win-win situations for all the nations and correspond to their increasing foreign trade supremacy(Bhattacharya & Bhattacharyay, n.d).

Kabir & Salim, 2010. Analyze the trading design of bangal Initiative for Multi Sectoral Technical and Economic Cooperation (BIMSTEC) by utilizing an ugmenting gravity model. The diagnostic test of the model shows that heteroscedasticity, serial correlating and contemporary correlation are permitted in the prais Winsten Regression of panel-specific AR(1) in import and exports panels. Regression estimations demonstrate that BIMSTEC's imports purse the hinder hypothesis, whereas the exports demonstrate Heckscher-Ohilm- Samuelson prototyping. Outcomes are recommended that the elasticity of distance is significant and negative. Real depreciation seems to be export enhancing and import-falling. Common lannguage and Bilateral trade agreement are found to be enhance the export and import reducing, respectively. Nation governance has show a positive effect on block trade.

Juan Haung, Chuanmin shuai, 2021. Analyze gravity model to find the factors which influence the bilateral tarde between China and Mongolia. Panel data from 1996 to 2019 were used for the analysis of the data. Unit root test, principal component analysis, and the estimation of coefficient were used in the panel data. Nine variables were include in the model, Gross domestic product (GDP, geographical distance, trade

agreements, exports, population, culture distance, trade facilitation index of china and mongolia–china trade cost were supposed to be for all models. The results shows that culture difference between china–mongolia is at a stationary level More–ever the results shows that if china impose a tax on the exports of mongolian product then the exports of goods from Mongolia to China show a decline trend, as the China economy is protective in nature by adopted restrictive laws and policies on the goods flow from Mongolia to China. This study suggest that the issue can be resolved by building up the trade agreement between mongolia and china.

CHAPTER 3: RESEARCH DESIGN

3. RESEARCH DESIGN.

3.1 Objective of the study

This section explains the research method that will be implement and how empirical data will be collected. In addition, methodological flaws are discovered in the data accuracy. the methodology section also contain details on the method of analysis that will be utilized to analyze the empirical data.

This paper is containing the empirical analysis of Pakistan's export with main trading partner, this paper cover 39 main trading partner of Pakistan by using the concept of gravity model. This paper tries to find the answer that what factors are mostly affected the export value of Pakistan.

The objective of the paper is:

1. To calculate the percentage change of exports value of Pakistan due to percentage change in the real GDP (Pakistan and partner country LnPGDP)

2. To calculate the percentage change of exports value of Pakistan due to percentage change in distance, as each partner country have different distance.
3. To calculate the percentage change in exports value of pakistan due to

percentage change in the Remote variable. Value for the remot variable can be calculated by multiplying GDP of partner country to distance and divide by world GDP.

3.2 Hypothesis of the study.

The hypothesis listed below were also investigated in order to meet the study major's and particular objective, as required in the quantitative research.

1. Real GDP of Pakistan have positive effect on Pakistan's export value of goods.

2. Real GDP of partner nation have positive effect on Pakistan exports.

3. Distance have negative effect on export value of goods.

4. Value of remote variable have positive effect on exports value of goods.

5. Terrorism have negative effect on Pakistan export.

6. Increase in cheap source of electricity have positive effect on pakistan's export.

7. Joining SAARC have positive effect's on Pakistan export's of goods.

All the following hypothesis are tested in the empirical data analysis, and the result will analyzed on the basis of these hypothesis.

CHAPTER 4: METHODOLOGY

4. DATA AND METHODOLOGY

This study covers the data from 2005 to 2019(14 years). For the exports of Pakistani goods, we choose 39 countries where more than 70% of Pakistan goods export to these countries base on SAARC (South Asia association for regional corporation), SAARC include 8 countries Pakistan, India, Nepal, Bangladesh, Sri Lanka, Bhutan, Afghanistan, Maldives and other major middle east countries and European countries also include United States. The data for, GDP, electricity production (Hydroeclectric source) are taken from the world bank, data for distance is obtained from www.indo.com/distance. Data for remote variable are created by multiplying GDP of the partner with the distance and divided by world GDP, data for world GDP are obtained from world bank. Data for export are obtained from IMF.

MODEL SPECIFICATION AND ESTIMATION

The gravity model is used to analyze the export performance of Pakistan. Log of export of Pakistan to its trading partner is dependent variable, log of product of GDP, log of distance, remote variable, log of terrorism incidence, log of total percentage of electricity from hydro source and dummy variable for SAARC as used as independent variable.

Variable	Discription
J	partner nation and t= Year(2005 to 2019)
I	Pakistan
LnExport	The natural log value of Pakistan export of goods to its trading partner
LnPGDP	The natural log of products of GDP(GDP of Pakistan and GDP of trading partner
LnDist	natural log of distance between Pakistan and trading partner country
LnRemote	the natural log of Remote
LnTer	The natural log of terrorism
LnEph	The natural log electricity production from the Hydroelectric source

4.1 PANEL REGRESSION

The gravity model is used in this research to examine trade theories with respect to trading nation and the panel data regression methodology is used to do the testing. This pooled dta methodology, which incorporate both cross-section and time series data, allow us to estimate difference among nations while also estimating changes across time at the same time. Basic panel data regression models include the pooled ordinary least square model (POLS), The random-effects model (REM) and the fixed-effect model. These are significantly different from the way the intercept term is treated, which is the term that indicates the impact of variables that are not included in the model.

Based on the premise that both the intercept and coefficient for each individual are constant across cross-sectional over time, the fixed effect model allow for heterogeneous intercepts across cross-sectional individual over time by utilizing a differential intercept dummy.

4.2 FIXED EFFECT MODEL

The fixed effect model is used to assess the impact of factors that are time invariant in order to determine their significance. A fixed effect model allows the intercepts in the regression model to vary between cross-sections. The link between independent and dependent variables is investigated by this model within an entity, and the results are presented. Independent variables may or may not be influenced by the unique traits of each particular entity depending on the situation.

4.3 RANDOM EFFECT MODEL

In order to investigate the variations in error variance components over time period or individual, the random effect model is used. It is assumed in this model that the variance between individual will be random and uncorrelated with the explanatory variables that have been included in it in a random effect model, it has been presumed that there is no association between any predictor variable in the data and individual effect (heterogeneity). On the basis of this assumption, the model calculates the error variance particular to groups of people.

4.4 Diagnostic test

When deciding which model is appropriate between random-effect model and fixed-effect model, Hausman test are employed to help make the decision, while deciding which model is appropriate between random-effect model and pooled OLS, Lagrange Multiplier test are performed to help make the decisions.

Deletion of endogenous regressors (predictor variable) in a regression model is accomplished using the Hausman tests. Endogenous variables are variable whose value are dictated by the values of other variables in a system. The Hausman test can be used to identify the most appropriate model from among the fixed effect model and the random effect model, depending on the data. Because this research is based on the panel data set, we employ the hausman test to identify which model is appropriate, while to choose between random-effect model and pooled OLS we apply the Lagrange Multiplier test.

CHAPTER 5: RESULT AND DISCUSSION

5.1 Descriptive statistics analysis

The following tables addresses the descriptive analysis of the bilateral trade flows of Pakistan and its trading partner and the explanatory variables. The descriptive statistics are shown the mean, standered deviation of the variables.

TABLE 2: Descriptive statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
LnExport	585	18.94652	1.497209	15.00335	22.19193
LnPGDP	584	52.8397	1.655294	48.0605	57.13078
LnDist	585	8.52521	.7770342	5.921578	9.721846
LnRemot	584	3.408154	1.877899	-3.224568	7.936334
LnTer	585	7.034805	1.410517	4.025352	9.034677
Lneph	585	3.424888	.044192	3.338258	3.517498
SAARC	585	.1025641	.3036483	0	1

The variables LnExport have 585 observations with the mean value of 18.94 and the standard deviation (S.D) 1.497. The maximum and minimum value of LnExport is 22.191 and 15.003.

The variables LnPGDP have 584 observations with the mean value of 52.839 and the standard deviation (S.D) is 1.655. The corresponding maximum and minimum value is 57.130 and 48.060.

The variables LnDist have total 585 observations with the mean value 8.825 and standard deviation (S.D) 8.525. The minimum and maximum value of variables LnDist is 9.721 and 5.921.

The variable LnRemot have total 584 observations with the minimum value 3.408 and standerad deviation (S.D) 1.877. The corresponding maximum and minimum value of variable LnDist shown in the table are 9.034 and 4.025.

The variable LnTer have total 585 observations with mean value of 7.034 and standard deviation (S.D) 1.410. The maximum and minimum value are 9.034 and 4.025.

The variable Lneph have total 585 observations with the mean value of 3.424 and standard deviation .044. The minimum and maximum value are 3.517 and 3.338.

The variable SAARC have total 585 observations with the mean of .102 and standard deviation .303. The corresponding minimum and maximum value are 1 and 0.

5.2 Regression Analysis

5.2.1 Pooled Regression

One sort of a model with constant coefficients, relating to both intercepts and slopes, is the pooled regression model. Researcher can use this approach to pool all the data and perform an ordinary least square regression model on it.

5.2.2 Correlation Analysis

The following table shows the result of correlation analysis

TABLE 3: Correlation Analysis

	LnExport	**LnPGDP**	**LnDist**	**LnRemot**	**LnTer**	**Lneph**	**SAARC**
LnExport	1.0000						
LnPGDP	0.5011	1.0000					
LnDist	-0.3467	0.1696	1.0000				
LnRemot	0.2857	0.8843	0.5627	1.0000			
LnTer	0.0190	-0.0430	-0.0028	0.0141	1.0000		
Lneph	-0.0188	-0.1556	0.0004	-0.0278	-0.1392	1.0000	
SAARC	0.2414	-0.2584	-0.6633	-0.5023	-0.0012	0.0002	1.0000

By using correlation analysis, we will know the exact and linear relationship among the variables. If there is an exact relationship exists between the variables, then there will be a problem for estimation. The table shows correlation analysis for the variables.

The above correlation results shows the positive or negative relationship between variables. The result shows that LnExport and LnPGDP is positive association which is 0.50. The variable LnExport and LnDist has a negative association. If LnDist increases, the LnExport decreases or vice versa. There is also a negative association between LnExport and Lneph. All other variable show a positive association.

5.2.3 Pooled Regression Analysis

Table 4: Pooled Regression Analysis

LnExport	Coef.	std. Err.	t-value	p-value
LnPGDP	.1176868	.1368582	0.86	0.390
LnDist	-1.101981	.1614173	-6.83	0.000
LnRemot	.4677524	.1420277	3.29	0.001
LnTer	.0189399	.0346252	0.55	0.585
Lneph	.6953356	1.234041	0.56	0.573
SAARC	.9340012	.201547	4.63	0.000
_cons	17.92562	10.99834	1.63	0.104

The result of the tables shows that the pooled OLS estimation. Here the dependent variable is log of export value of goods with trading partner

country. According to the gravity model GDP (Economy size) is directly related to the trade and inversely related to the distance between them. As we expect that if the GDP increase the trade or export will also increase. The pooled OLS show the same result, here the export increase as the economy size of both the countries increase and the distance show a negative result.

According to pooled OLS estimation the distance, Remot, and SAARC variable are statistically significant. The expected value of variable LnTer is different for this analysis.

The pooled OLS suggest that if the size of economy that is GDP of both the country increase by one percent it will cause increase of Pakistan export by .1% keeping the other variables constant. The result for the distance is relavent to the gravity model, its show decrease in trade when the distance is increase. Pooled OLS suggest that if the distance is increase the export of Pakistan to that particular country is decreased.

The remot variable which is consider to economic weight show a positive effect on Pakistan exports. Increase in percentage of hydro source of electricity also show a positive effect on Pakistan export. Joining a SAARC show a positive effect on Pakistan Export but it is not significant. Social safty or terrorism show an unexpected result as it show positive effect in Pakistan export which will be explain in the random-effect model.

The pooled OLS doesn't allow the intercept term varying over the time in term of partner nation. In the panel analysis it is very important to use the random effect and fixed effect model.

5.2.4 FIXED EFFECT MODEL

This section explain the result of fixed effect-model. The result of fixed e ffect model is shown in the table

Table 5: FIXED EFFECT MODEL

LnExport	Coef.	Std.Err.	t-value	p-value
LnPGDP	.1959493	.0551343	3.55	0.000
LnDist	-.6233435	1.225602	-0.51	0.611
LnRemot	.1314691	.1086033	1.21	0.227
LnTer	.0329404	.0131066	2.51	0.012
Lneph	.8022939	.4523997	1.77	0.077
SAARC				
_cons	10.48619	11.38945	0.92	0.358

Number of obs = 584

F(5, 540) = 12.54

Prob > F = 0.0000

R-Squared = 0.48

Results of the fixed effect model in the table shows that Pakistan's export are positively related to size of the economy of Pakistan and partner country. The table also indicate that distance is negatively related to Pakistan which is in conformity with the earlier results of gravity model. The economic weight or remote also show a positive effect on Pakistan export. From the table it is clear that increase in production of electricity from cheap source (Hydroelectric source) have also a positive

impact on Pakistan's export. Result for social safety or impact of terrorism show a positive effect which is unexpected. The dummy variable SAARC is omitted from the fixed effect model because of collinearity. Economy size (GDP) and social safety variable have a high significant effect in the fixed effect model.

5.2.5 RANDOM EFFECT MODEL

This section explain the result of random effect model. The following table shows the result of random-effect model.

TABLE 6: RANDOM EFFECT MODEL

LnExport	Coef.	Std.Err.	t-value	p-value
LnPGDP	.1709788	0.537336	3.18	0.001
LnRemot	-.8541413	.2990541	-2.86	0.004
LnDist	.2337149	.0953779	2.45	0.014
LnTer	.0295086	.0129701	2.28	0.023
Lneph	.7625919	.4526928	1.68	0.092
SAARC	.7049032	.7425135	0.95	0.342
-cons	13.51096	4.976447	2.71	0.007

No of Obs = 584
Prob > F = 0.0000
R Squared = 0.49
F (38, 540) = 103. 78

The table show results of the random effect model. This results of gravity model is based on Pakistan's GDP, Partner GDP, distance, remote value, chief source of electricity production, Social Safty(Terrorism) and SAARC. All the variable except SAARC show a significant impact on Pakistan export. The results show that increase in domestic GDP as well as Partner GDP cause exports to enhance. It show that 1% increase in both GDP will cause Pakistan's export to increase .17%. The distance show negative effect on exports, these finding are similar with large number of

previous studies that shows trade increase as size of the economy increase and decrease with the distance.

The simple distance in the gravity model cannot explain Pakistan's export performance, that can be explain by remote variable which show a positive impact on Pakistan's export, remote variable explain why USA and EU is the largest trading partner of Pakistan which is more in distance as compared to china and India one of the two biggest economy which shared a common Boarder with Pakistan or with less distance as compared to USA and EU, value of the remote variable are determined by multiplying GDP of the partner with distance from Pakistan and divided by world GDP.

Value of remote variable are large FOR USA and some European Country. The social safty or terrorism show positive effect on Pakistan exports which is unexpected, this factor can be explain by as Pakistan join US war on terror and the US provide economic assistance 744.72 million dollars in (2002) and increase each year and in 2010 its reach to 1529.53 million dollars (The Guardian). GSP plus status were also provide to Pakistan from European Union. By the intervension of US the paris club provide 12.5 billion dollars loan to Pakistan with more generous term (www.jstor.org). these factor help Pakistan economy to make it stable which is effected by terrorism. The results also show that joining SAARC have a positive impact on Pakistan export but it is not significant. India and Afghanistan is also a part of SAARC although there is some problem of Pakistan with India and Afghanistan remain a war torn country from two decades, due to these problem Pakistan do not share large amount of exports to these countries.

5.2.5 FIXED AND RANDOM EFFECT MODEL

Following are the result of fixed and random effect model.

TABLE 7: FIXED AND RANDOM EFFECT MODEL

Variable	Fixed Effect Model		Random Effect Model	
	Coefficient	p-value	Coefficient	p-value
LnPGDP	.1959493	0.000	.1709788	0.001
LnDist	-.6233435	0.611	-.8541413	0.004
LnRemot	.1314691	0.227	.2337149	0.014
LnTer	.0329404	0.012	.0295086	0.023
Lneph	0.80229339	0.077	.7625919	0.092
SAARC	0		.7049032	0.342
_cons	10.48619	0.358	13.51096	0.007
	***P<.01, **P<.05, *P<.1			
	prob: 0.0000 (F test)		prob : 0.0000 (F test)	

The above table show the comparison between random and fixed effect model. In fixed effect model variable LnExport, LnTer and Lneph are statistically significant at 1%, 5% and 10% level of significance. The variable SAARC in the fixed effect model are omitted because it is a dummy variable its value does not change in time while the same variable in the random effect show a positive effect on Pakistan export. All the variable in random effect model are significant except SAARC at 1%,5% and 10% of significane level. All the variable in pooled OLS, fixed effect model, random effect model show positive effect except Distance which show a negative effect. The value of R-2 is .50 which is describe 50% by explanatory variable and 50% by residual. This effect

show that the model is good.

As the GDP of both the partner and Pakistan increase, fixed-effect model and random-effect model shows there's increase in exports. US GDP is the largest in the world followed by china and some European Country, According to world bank Pakistan exports to US in 2019 ($4.03 billion) with a partner share of 16.97 %. Pakistan exports to china ($2.03 billion) which constitute 8.58 percent share. Pakistan exports to United kingdom ($1.67 billion) with a total percent share of 7.06. Pakistan exports to Germany ($1.34 billion) having a partner share of 5.65 %. Exports to Afghanistan are ($1.18 billion) total shares 4.97 percent.

As the distance between the two trading nation closer, then higher trade between the two nation has occurred. Results of both model in the table show that distance have relatively negative effect on Pakistan exports.

The remote value also shows the positive effect on Pakistan exports, this result suggest that Pakistan have more potential of exports to that countries having highest GDP in the world.

The social safty or terrorism show a positive effect it suggest that Pakistan need to make a good ties with Developed countries as they provide assistance to Pakistan whenever there is unfavorable condition to Pakistan economy.

The result also shows that availability and price of energy have impact on Pakistan's export. It shows that increase in production of cheap source of electricity have positive effect on Pakistan's exports, Pakistan need to focus on building a new dams which will increase cheap source

of electricity to the system and then it will provide with a cheap price to industrial sector as well as other sectors.

Results show that joining SAARC (South Asia Association for Regional cooperation) have positive effect on Pakistan exports but Pakistan exports to India and Afghanistan shows decline, the main reason is that Pakistan share a dispute territory with India and Afghanistan remain a war torn country from two decades.

5.2.6 HAUSMAN TEST

By choosing between fixed-effect model and random-effect model Hausman test is performed. There are two hypothesis of hausman test.

1 NULL HYPOTHESIS

2 ALTERNATIVE HYPOTHESIS

If the P value is less than 0.05 or less than 5% then the null hypothesis is rejected and it suggests that fixed-effect model is appropriate while if the p value is more than .05 or 5% it reject the alternative hypothesis and suggest that random-effect model is appropriate. The following table shows the result of hausman test.

TABLE 8: HAUSMAN TEST

	Coefficients			
	(b) fe	(B)re	(b-B)Difference	S.E
LnPGDP	.1959493	.1709788	.0249705	.0123486
LnDist	-.6233435	-.8541413	.2307978	1.188557
LnRemot	.1314691	.2337149	-.1022459	.0519397
LnTer	.0329404	.0295086	.0034318	.0018862
Lneph	.8022939	.7625919	.039702	

b = consistent under Ho and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test : Ho: difference in coefficient not systematic

chi2(5) = (b-B)' [(v_b-V_B)^(-1)](b-B)

= 3.88

prob>chi2 = 0.5664

(V_b-V_B is not positive definite)

By testing the hausman method we find the best model that fit according to these data. Following are the hypothesis of the hausman test.

NULL HYPOTHESIS : REM is better.
ALTERNATIVE HYPOYHESIS : FEM is better.

Here the probability value of chi 0 is 0.5664 which mean that the altern ative hypothesis is rejected is rejected or REM is appropriate may not be rejected.

Result of the hausman test confirms that alternative hypothesis is rejected and null hypothesis is accepted. The tests confirm that random-effect model is better than fixed-effect model. Random-effect model is good fit

to analyze the data by approaching the Gravity model

5.2.7 LM TEST (BREUSCH AND PAGAN LM TEST)

When hausman test suggest that random-effect model is appropriate after that one another test is performed which is called breausch and pagan Lagrangian multiplier test which suggest to choose between random-effect model and pooled OLS model. The following tables shows the result of LM test.

TABLE 9: LM TEST

	Var	sd = sqrt(Var)
LnExport	2.22323	1.49105
e	.1563092	.3953596
u	1.107911	1.052573
	Test: Var(u) = 0	
	chibar2(01) = 3037.57	
	prob > chibar = 0.0000	

The table shows the result of Breusch and pagan Lagrangain multiplier test. This test is performed with panel data when the hausman test suggest to use the random-effect model in order to choose between the random-effect and pooled OLS, If the P value is more than .05 or 5% then it suggest to choose the pooled OLS model rather than random-effect model, if the P value is equal or less than.05 then it suggest to analyze the random-effect model in the gravity model data analysis.

The table show that the P value equal to 0.0000 which is less than 0.5, its mean than random-effect model is appropriate rather than pooled OLS model. In random effect model all the variable show significant impact at 1%, 5% and 10% level except the SAARC variable which is not significant. In random effect model GDP, remote, terrorism, cheap source of electricity show positive effect on Pakistan's export. By increasing all the variables will increase Pakistan's export. The SAARC variable also shows positive effect, although it is not significant.

The Distance show relatively negative impact on Pakistan's export, its mean closer the trading partner's country more will be the export. India and Afghanistan share a common Boarders with Pakistan Or it is more closer to Pakistan but the export performance to these countries are not satisfactory as India and Pakistan share a dispute territory mostly their relation are not goods because of these factor it effects Pakistan's export to India. Afghanistan remains a war torn country from few decades, or because of stability problem it is Difficult to trade with Afghanistan on a large scale.

CHAPTER 6: CONCLUSION

The results in this study are quite same with the overall study results obtained from gravity model used in other studies, although terrorism show positive effect. We estimated all model pooled OLS, Fixed-effect model, Random-effect model but the Huasman test suggest that fixed model is appropriate and the Breusch and pagan or LM test showed the appropriateness of random-effect model to be used for this study. Results showed that size of the economy measured by GDP have significant impact on Pakistan's export.

Distance variable has expected negative results, there are another factors related to distance which effect pakistan's export which are accounted in our model, Remote which show positive effect on Pakistan exports, this factor successfully explain that far away countries like USA and some European countries which is the largest trading partner of Pakistan.

The distance of simple gravity model cannot explain why USA and some European countries is largest trading partner to Pakistan. therefore, by adding remote variable explain these factor. Membership in SAARC have the positive impact on trade.

Therefore, it is suggested that Pakistan need to normalize the ties with India which is also the member of SAARC and also share a common boarder with Pakistan.

The results also indicate power supply show significant impact on Pakistan exports. Pakistan produce electricity from various sources includes, electricity from coal, electricity from hydro sources, thermal

electricity and also import electricity from Iran. Electricity from hydro sources such as dams are consider the cheap source.

The results shows that increase in electricity from cheap sources positively impact Pakistan's export. Therefore it is suggested that need to allocate budget for new dams, electricity from cheap sources reduce the price for power supply to the manufactured site and it help to increase production with low cost.

The goal of this study of this study was to establish a theoretical basis for applying a gravity model in a bilateral trade analysis, as well as to use the gravity model to analyze Pakistan's export with its key trading partners using the panel data estimating technique. We have established that using the gravity model in practical bilateral trade research is theoretically justified.

One of the limitation of this research is that multilateral resistance factor is not considered for Pakistan's export because of their complex nature and not easily calculated.

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Appendices

The exports value of pakistan to its trading nations data is given below i n the table.

EXPORT WITH ASIAN COUNTRY

Year	Bangladesh	Iran	Srilanka
2005	234360000	178360000	153740000
2006	268840000	178780000	177590000
2007	279250000	146240000	208570000
2008	422340000	426180000	216720000
2009	365170000	252660000	213050000
2010	636810000	182190000	283870000
2011	947230000	153270000	347720000
2012	696010000	141950000	300900000
2013	718380000	62640000	316380000
2014	687640000	43050000	266150000
2015	700570000	32290000	260010000
2016	656160000	35560000	237180000
2017	644170000	26340000	269260000
2018	746420000	21370000	367220000
2019	750120000	4630000	321310000

EXPORT WITH ASIAN COUNTRY

Year	Afghanistan	India	China
2005	1065060000	337390000	435590000
2006	991500000	326700000	506640000
2007	837680000	291700000	613760000
2008	1447620000	354640000	726710000
2009	1357550000	231870000	937820000
2010	1684670000	274980000	1435940000
2011	2660300000	272860000	1678960000
2012	2099280000	347990000	2619940000
2013	1998110000	402750000	2652220000
2014	1879140000	392210000	2252900000
2015	1722220000	312280000	1934930000
2016	1369770000	348100000	1590860000
2017	1389700000	334860000	1459740000
2018	1211170000	377080000	1844390000
2019	1192630000	69620000	2003770000

EXPORT WITH ASIAN COUNTRY (MIDDLE EAST)

Year	Saudi Arabia	U.A.E	Qatar
2005	354940000	1256220000	40330000
2006	309030000	1241820000	47500000
2007	295100000	2114710000	94180000
2008	441060000	2009810000	188870000
2009	425160000	1477800000	147620000
2010	409050000	1834910000	110760000
2011	420180000	1920960000	115370000
2012	455630000	2872870000	79220000
2013	944310000	1775140000	78760000
2014	509700000	1324080000	78840000
2015	431310000	899030000	63330000
2016	380440000	784750000	61690000
2017	428250000	832660000	63810000
2018	295410000	926950000	102920000
2019	398090000	1105810000	116860000

EXPORT WITH ASIA COUNTRIES

Year	Hong Kong	Indonesia	Singapore
2005	598840000	68270000	32430000
2006	678730000	61930000	56730000
2007	608050000	66460000	61570000
2008	461180000	63050000	47790000
2009	351050000	66270000	34580000
2010	495230000	73850000	71600000
2011	420730000	188530000	65390000
2012	416220000	236320000	59370000
2013	408460000	144380000	86270000
2014	328310000	138170000	245090000
2015	241710000	140750000	209230000
2016	149570000	127690000	67180000
2017	112100000	153270000	62670000
2018	105310000	317370000	102930000
2019	98430000	144550000	83180000

EXPORT WITH US, UK, GERMANY

Year	United States	U.K	Germany
2005	3978750000	907630000	724620000
2006	4343420000	935870000	697540000
2007	3853470000	967380000	725950000
2008	3653920000	1000420000	880000000
2009	3178050000	931900000	705520000
2010	3674480000	111380000	981220000
2011	3839160000	1258790000	131220000
2012	3668510000	1247440000	988520000
2013	3746250000	1431960000	1080980000
2014	3646510000	1654640000	1215480000
2015	3661590000	1572800000	1146260000
2016	3429740000	1557630000	1186250000
2017	3551780000	1625940000	1266000000
2018	3740790000	1714330000	1284950000
2019	4010580000	1659430000	1325220000

EXPORT WITH EU(Netherlands, spain, Belgium).

Year	Netherlands	Spain	Belgium
2005	378320000	396000000	342090000
2006	433860000	476320000	340860000
2007	452950000	486000000	361030000
2008	560130000	491050000	428320000
2009	390890000	406130000	393250000
2010	408080000	474140000	518870000
2011	535410000	569710000	657630000
2012	449170000	503520000	494860000
2013	627520000	602480000	571930000
2014	684740000	789830000	658060000
2015	666950000	782260000	592170000
2016	650800000	837340000	650640000
2017	757780000	904980000	666820000
2018	941070000	922550000	661740000
2019	1041960000	947160000	587590000

국 문 초 록

파키스탄의 수출결정요인에 대한 중력접근법
: 중력모형의 패널해석

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국 제 무 역 경 제 학 과
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자 키 르 알 리

본 연구의 목적은 파키스탄 수출에 영향을 미치는 다양한 경제적 요인을 파악하는 것입니다. 2015년부터 2019년까지 15년에 걸쳐, 주요 무역 파트너에 대한 파키스탄 수출 흐름의 패널 중력 모델을 평가하기 위해 포괄적인 데이터 세트가 생성되고 사용되었습니다. 첫 번째 단계에서는 패널 데이터에 대해 간단한 회귀 또는 OLS 추정이 수행됩니다. 두 번째 단계에서는 고정 효과 모델을 테스트하고 마지막 단계에서는 랜덤 효과 모델을 적용했습니다. 그런 다음 고정 효과와 랜덤 효과 사이에서 모형을 선택하기 위해 하우스만 검정을 추정합니다. Hausman 검정을 활용하면 고정 효과 모델보다 랜덤 효과 모델을 선택할 수 있습니다. 다음 단계에서는 랜덤 효과 모델과 OLS 모델 중 하나를 선택하기 위해 LM 테스트라고 하는 다른 테스트를 수행했습니다. 이 검정은 랜덤 효과 모형이 단순 OLS보다 낫다는 것을 나타냅니다. 논문에 대해 선택된 데이터는 매우 균형 잡힌 데이터입니다. 파키스탄에 미치는 영향

을 찾기 위해 사용된 변수로는 파키스탄과 개최국의 GDP, 거리, 원격성 변수, 파트너국의 1인당 GDP, SAARC가 파키스탄 수출에 미치는 영향 등이 있습니다. 이 세 가지 모델은 모두 GDP와 원격성이 긍정적이고 거리가 부정적인 효과를 나타내며, 수출국가의 GDP가 높을수록 수출국, 무역상대국과의 거리가 가까울수록 수출국 간의 무역이 증가한다는 것을 보여줍니다. SAARC가 파키스탄 수출에 긍정적인 효과를 보이는 반면, 1인당 GDP의 변수는 마이너스를 보입니다.

키워드: 중력 모델, 패널 회귀 모델, 랜덤 효과 모델, 고정 효과 모델, SAARC, 파키스탄의 무역 가치.