IMPACT OF GRAVITY MODEL ON TRADE BETWEEN CHINA AND PAKISTAN: A CASE OF CPEC BETWEEN CHINA AND PAKISTAN

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ABSTRACT

To find out the trade flow among different economies, the gravity model has been applied in various researches in different regions of the world. The present study has applied the Gravity model to analyze the bilateral trade patterns between China and Pakistan. The secondary panel data was collected from 2009 and 2018. The variables used in the study were Distance, Inflation, Gross Domestic Product (GDP), and GDP per capita, Exchange Rate. The data was collected from the official websites of State Bank of Pakistan, the Pakistan Economic Survey, and the Pakistan Stock Exchange. The fixed effect regression model was used for analysis. The results showed that the Distance, GDP growth, GDP per capita had an insignificant impact on the Trade Flow between China and Pakistan. The Exchange Rate and Inflation showed a positive and significant effect on trade between China and Pakistan. The results recommended that further studies should be done targeting other potential variables with different mediating and non-mediating roles.

Keywords: Gravity Model Trade, CPEC

1. INTRODUCTION

The prolonged trade deficit and debt trap had damaged the economy of Pakistan severely, so to recover from this trap CEPEC is a great opportunity. The location of Pakistan for trade is very attractive to the world economy due to its proximity with china India and Afghanistan. The initiative of China and Pakistan for the development of CPEC has created a great opportunity for Pakistan to boost its economy. In order to analyze the effectiveness of this project gravity model was applied as it is a mainstream model developed from Newton's law of attractive energy. Tinbergen (2011) utilized a gravity model to discover the connection between Gross Domestic Product (GDP) and trade stream. Baroncelli (2007) applied the gravity model to assess benefits from trade between Pakistan and India and suggests that friendly relationship between both countries can impact positively by increasing trade. Increased trade help develop healthy relationships between countries as it provides two-way benefits. Gul and Yasin (2011) used gravity model between Pakistan and different Asian countries and suggested that Pakistan can benefit a lot with increased trade with Asian countries. The gravity model was frequently utilized in the global economy to analyze the effect of various trade policies on trade patterns between countries. There

are several studies that have explained the application of gravity models from different perspectives. Atif, Haiyun, and Mahmood (2019) applied augmented gravity model and applied Stochastic Frontier Analysis to find the determinants of exports of chemical industry with 62 different countries from 1995 to 2015. The results suggest that exports of chemical product follow gravity patterns.This result suggest a significant negative relationship between import tariffs and positive impact of devaluation. The results also showed a positive impact of preferential trade agreements due to common language, colonial links, political disputes but negative impact of and contiguity. Greaney and Kiyota (2020) applied gravity model for final and intermediate products and showed that the structural gravity model can better explain trade patterns of final and intermediate goods. Morland, Schier, and Weimar (2020) applied gravity model to determine trade potential of Pak China trade and suggested that CPEC can play a major role in trade creation between both countries.

2. THEORETICAL BACKGROUND

The gravity model is derived from Newton's universal Gravitation law, The applied gravity on international trade Poyhonen (1963) suggested that trade flows between two countries like gravitational force between two objects are dependent of their masses in which GDP can be used as proxy for masses and negatively relegated with distance and transportation cost can be used as proxy for the distance.

Gul and Yasin (2011) suggested that gravity model can be used to predict the trade potential of the country in the world, they suggest a very high potential for Pakistan in Asia Pacific region. Malik and Chaudhary (2012) applied the gravity model with the help generalized least square method on panel data. Empirical results suggested that income, trade rate, and openness of selected Asian Countries' can play a significant role in increasing the trade flows of Pakistan. Whereas, infrastructural bottlenecks had a negative impact on Pakistan trade. Rosmaiza, Cameron, Cochrane & Roskruge (2020) suggested that trade and migration and explained that large migration flow is associated with large trade flow and vice versa.

Hussain (2017) applied gravity model using the data from 1993 to 2017 from Pakistan and China and suggested that globalization had brought positive impact on GDP growth rate, international trade, and well-being in society around the world. The result showed positive impact of CPEC on Pakistan economy. Munir and Sultan (2017) applied gravity model to find trade determination of Pakistan. The panel data from 2000 to 2013was used and suggested a very high potential for Pakistan in Chinese market.

Atif, Mahmood, Haiyun, and Mao (2019) Analyzed data from Afghanistan, Bangladesh, China, France, Germany, Italy, Spain, UAE, UK, and USA. The study used panel data from 2006 to 2015 by employing the new estimation techniques of the stochastic frontier gravity model. The results suggest positive impact of trade on income of the major importing countries and negative impact on distance with countries. Estimates show that agricultural exports are best determined by Pakistan's GDP and importers GDP while has negative relationship with geographical distances. Khan and Khan (2019) analyzed strategic impact of China-Pakistan Economic Corridor (CPEC) for both Pakistan and China. Providing shortest trade route to China to Europe through South Asia, Central Asia, West Asia. It can also facilitate china for oil transportation and enable china to have a cost-efficient trade route in the world. Additionally they also suggested that this route will enhance bilateral trade between Pakistan and India.

Naz and Ali (2018) suggested that financial development has a positive impact on trade between the nations. It implies that as fare increases, it prompts an expansion in monetary development by using the data from 1981 to 2016.Their study showed an impact on gross domestic product on the trade patterns and overall growth of the economy. They suggested that Megaproject of CPEC can be very helpful in increasing the significance and financial performance of Gwadar-port (GP) by accelerating trade

between both countries in coming years. Additionally, it can be considered as a cornerstone in the financial improvement of Baluchistan region and Pakistan. In general, it has a positive effect. Furthermore, in trade. Abbas, Liu, Wasti, Munir, and Abbas (2019) emphasized importance of CPEC on different sectors of Pakistan. They focused on three aspect of the economy including personal income, employment, GDP and foreign direct investment. They used qualitative approach using in-depth interview method for data collection. Their finding suggests that CPEC will not only benefit for China and Pakistan but for the whole region by providing employment and upgrading standard of living of the people increasing the GDP of the country posing not a single threat to both countries. Alam, Li, and Baig (2019) Clarified that China is the World's second-greatest economic country and practically 40% of its trade in 2016 shipped through the South China Ocean. At that point, China needs a little security and minimal effort to trade with the Center East and Europe, so the CPEC Megaproject settles this necessity. Furthermore, CPEC Megaproject is affecting the trade in term of transportation cost and travel time, so these are acceptable open doors for China and Pakistan on the basis of Trade.

Karkanis, and Fotopoulou (2021) applied augmented gravity model using ordinary least squares Poisson pseudo maximum likelihood (PPML) estimators to find determinants of Chinese imports from 1995 till 2018, The results suggest complementarity among Chinese demand and global commodity markets. Free trade agreements between China and third countries appear to be slowly losing ground, as China's economy merges with world trade. The fragmentation of high-quality products in the export markets of China's trading partners can be instrumental in facilitating market entry. The fragmentation of energy resources, stability, high demand for infrastructure and highly complex consumer products determines China's commodity purchases that are largely and increasingly emerging in countries with direct access to the Pacific Ocean.

The present study tried to test the trade potential between China and Pakistan and the effect of CPEC Megaproject on the future trade patterns between both countries. This study intends to discover the application of the Gravity Model on Bilateral Trade with the assistance of CPEC Megaproject on the base of Trade among China and Pakistan and to examine factors that can accelerate Trade between China and Pakistan. The main objective of this study was to find significant elements which can accelerate trade among China and Pakistan and to see whether distance has significant impact on trade flows of the country and to identify the primary effects of the CPEC Megaproject on the economy of Pakistan. This work will help to clarify the importance of CPEC project for economy of Pakistan and help in clarifying the aspects of this mega project and the benefits which can be availed with increased trade between both countries. This work will also help policy makers to see the effectiveness of their policies.

Independent Variables

Fig 1: Theoretical frameworks
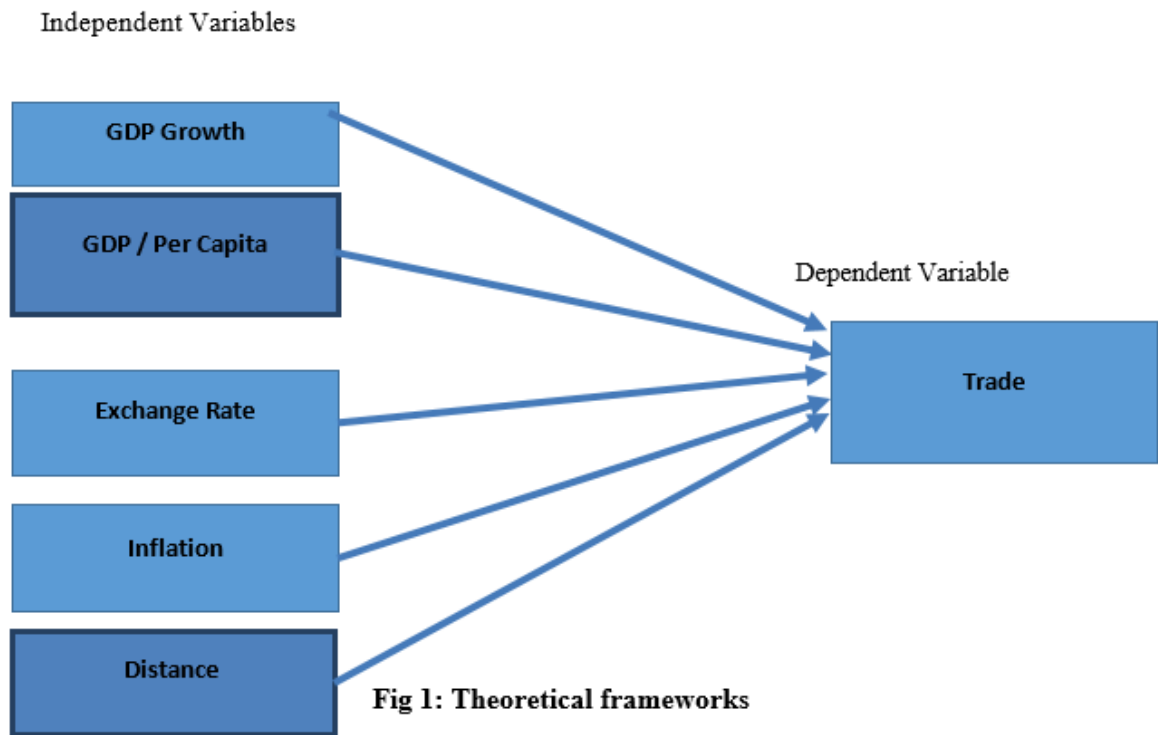
2.1 Research Hypothesis

H1 = GDP has a significant impact on trade between China and Pakistan

H2 = Per Capita / GDP has a significant impact on trade between China and Pakistan.

H3 = Inflation has a significant impact on trade between China and Pakistan.

H4 = Distance has a significant impact on trade between China and Pakistan.

H5 = The exchange rate has a significant impact on trade between China and Pakistan.

3. RESEARCH METHODOLOGY

The study used secondary data on different macro-economic variables of Pakistan and China

from the website of the State Bank of Pakistan

The Gretl software and excel spreadsheets were used for data analysis. The sample size consists of ten years from 2009-2018. The fixed effect regression model was applied to the data. The following econometric model was developed from the study of Tinbergen's (1962) old Model of Gravity:

$$InExport_{ij} = \beta 0 + \beta 1 \, InY_i + \beta 2 \, InY_i + \beta 3 \, DIS_{ij} + \varepsilon_{ij}$$ ---------------------- (III)

The above equation is suggesting that the exports of the country (i) with the country (j) depends on the GNP of the country (i) and in the country (j) the value of Distance was taken as a proxy for the Transportation Cost.

Where:

Xij= Trade flow from country (i) to (j)

Yi= Gross Domestics Products (GDP) of the country i

Yj= 1 Gross Domestics Products (GDP) of the country j

Ni= Population size of the country.

The nj= Population size of the country js

An ij= any other factors impact trade between country (i) and (j)

In this equation, the basic gravity equation for regression analysis takes the following from that all variables are the equation in the normal logarithm from and among the explanatory variables, GDP Per Capita of the gross domestic product, Exchange Rate, Inflation and distance services as a trade base proxy on the trade between China and Pakistan, as well as those, that are more likely to enter economies of scale and increase their exports on a comparative advantage , they have large domestic markets that are capable of absorbing further exports from China to Pakistan. Therefore, that is an increase in the output of both countries on the basis of trade and that is a big impact on the trade prospective of the countries and as well as the GDP is projected to increase the volumes of the trade between China and Pakistan and also it has a significant impact on the trade between China and Pakistan.

The augmented Gravity Model:

$$Log(tradei) = \alpha + \beta1 \log \log(GDPiGDPj) + \beta2 \log \log(PCDGPiPCDGPj) + \beta3 \log \log(Distanceij) + \beta4 \log \log(Borderij) + \beta5 \log \log(PCDGDPD) + \beta6 \log(Inflation) + \mu……………………..1$$

4. RESULT, DISCUSSION & ANALYSIS

Tab 1: Descriptive Statistics

Variable	Mean	Median	Minimum	Maximum	Std. Dev.	C.V.	Skewness	Ex. Kurtosis
GDP Per Capita	4104.750	2653.12	958.000	9770.850	3210.460	0.782	0.415	-1.4697
GDP Growth	-30.180	6.889	-817.182	71.890	185.870	6.159	-4.081	14.814
Exchange Rate	55.240	44.970	6.050	128.000	51.375	0.930	0.154	-1.789
Inflation	0.050	0.036	-0.073	0.139	0.052	1.048	0.105	0.270
Distance	3283.00	3283.00	3283.00	3283.00	0.000	0.000	Undefined	Undefined
Trade	3.230	2.912	0.016	7.022	3.284	1.017	0.027	-1.963

The table 1 is about the Descriptive Statistics of the data for the relevant result. The mean of GDP per capita is higher and Inflation is the lowest among in the table 1.

Tab 2: Correlation Matrix

	GDP Per Capita	GDP Growth	Exchange Rate	Inflation	Distance
GDP Per Capita	1.000	0.333	-0.882	-0.580	0.021
GDP Growth		1.000	-0.193	-0.106	0.169
Exchange Rate			1.000	-0.528	0.262
Inflation				1.000	0.179
Distance					1.000

From the table 2 shows, it is found that GDP per Capita, inversely correlated with inflation and exchange rate while GDP growth is negatively correlated with inflation and exchange rate. Overall, the correlation between independent variable is not very high therefore problem of multi collinearity is not present in the data.

Tab 3: Regression Results

	Coefficient	Std. Error	t-ratio	p-value	
GDP Per Capita	-0.00015	9.734e-05	-1.63	0.12	
GDP Growth	-0.00040	0.0007	-0.51	0.61	
Exchange Rate	0.04635	0.0055	8.32	<0.00001	***
Inflation	13.0187	3.1290	4.16	0.00	***
Distance	0.0002	0.0002	0.91	0.373	

R-squared	0.976066
$F_{(4, 15)}$	152.9338
Adjusted R-squared	0.969684
P-value(F)	5.79e-12

The table 3 presents Regression analysis for the data. GDP Per Capita shows a t value of -1.63 and p-value 0.12 showing a negative and insignificant impact on trade flows between both countries. GDP Growth has a t value of -0.51 and p- value 0.65 showing a negative and insignificant impact on trade flows between China and Pakistan. Exchange Rate has a t value of 8.32 and p- value 0.00001 a positive and significance impact on the Trade Flows between China and Pakistan. Inflation has a t value of 4.16 and p- value 0.00 showing a positive and significance impact on the Trade Flows between China and Pakistan. The Distance has a t value of 0.91 and p- value 0.373 a negative and insignificant impact on the Trade Flows between China and Pakistan. The adjusted R square value is 0.69684 which shows that 69.84 % changes in the trade flows between Pakistan and China is due to the variables identified in the model. The F- statistics showed the value of 152.93 which suggest that overall model is significant.

3.2 Discussion & Analysis

The gravity model was used in this study to find out the impact of trade flow between China and Pakistan from the year 2009 till 2018. The data was collected from the official websites of State Bank of Pakistan, Economic surveys, and other relevant sources. The independent variables were GDP, GDP per Capita, Rate of exchange, Inflation, Distance and dependent variable was trade flow between China and Pakistan.Tthe result suggests that overall model is significant but only exchange rate and inflation variable is significant in the model.

The Regression analysis revealed that GDP growth shows a negative and insignificant impact on trade flows between both countries thus rejecting the first hypothesis of significant relationship between GDP growth and trade Flow between Pakistan and China. This result is not consistent with the result of Atif, Haiyun, and Mahmood (2016), Naz and Ali (2018) and Morland, Schier, and Weimar (2020). GDP per capita has an insignificant negative impact on trade flows between China and Pakistan, thus rejecting the second hypothesis of significant relationship between per capita GDP and trade flows between Pakistan china.This result is not consistent with the result of Atif, Haiyun, and Mahmood (2016),

Exchange Rate has a positive and significance impact on the Trade Flows between China and Pakistan thus accepting the third hypothesis of significant relationship between exchange rate and trade flows between Pakistan and china. (Wang & Badman 2016). Inflation has a positive and significance impact on the Trade Flows between China and Pakistan accepting the fourth hypothesis of significant relationship between Pakistan and china. This result is consistent with the results of Rahman (2005), Roy and Rayhan (2011) but negates the finding of Kaur and Nanda (2010) and Gul and Yasin (2011).

Distance   showed a negative and insignificant impact on the Trade Flows between China and Pakistan thus rejecting the fifth hypothesis of significant relationship between Pakistan and china negating the results of Wang and Badman (2016) and Fatima, Baig, and Shah (2019).

4. CONCLUSION

The study aimed to examine the application of Gravity model on trade flows between China and Pakistan. The gravity model has significant explanatory power and also explains and extends trade between China and Pakistan. The variables used in the study were Distance, Inflation, GDP, and GDP per capita, Exchange Rate. The data was collected from the official websites of State Bank of Pakistan, Pakistan Economic Survey, and Pakistan Stock Exchange. The regression model was applied for analysis. The results revealed that the Distance, GDP growth, GDP per capita had insignificant relationship with the Trade Flow between China and Pakistan. The Exchange Rate and Inflation showed

positive and significant impact on trade between China and Pakistan. The results suggested exchange rate stability is very important for significant improvement in trade flows for Pakistan and also suggests that CPEC Project will be very beneficial for Pakistan economy. The study recommended that further studies should be done targeting other potential variables with different mediating and non-mediating roles. For both the countries through CPEC, China got the doorway to the Middle East and Pakistan can also get benefits out of it. Future scholars should study more deeply into the topic with more recent data and tools, which will help in exploring more critical points in the findings.

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