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Enhancing India's Export Growth to GCC: A PPML Approach to Gravity Model Optimization

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ARTICLE INFO	ABSTRACT
	Introduction: This paper explores the dynamics of India's exports to the Gulf Cooperation Council (GCC) countries over the period 1996 to 2023. It addresses the economic, geographical, and historical factors influencing trade between India and the GCC region. **Objectives**: The primary objectives are to identify the key determinants affecting India's exports to GCC countries using an augmented gravity model with remoteness indexes, and to analyze export patterns across the GCC countries and India. **Methods**: An augmented gravity model incorporating remoteness indexes was employed to assess bilateral trade flows. Variables such as GDP, distance, shared colonial history, and language ethnicity were analyzed. **Results**: Findings indicate that GDP significantly promotes exports, while distance acts as a major deterrent. The common colony variable shows a positive effect, whereas shared language ethnicity has a surprising negative impact. The remoteness indexes for both importers and exporters negatively affect trade, highlighting the importance of multilateral resistance. **Conclusions**: The study provides a nuanced understanding of the trade dynamics between India and GCC countries. It emphasizes the importance of geographical and historical linkages, and the need for policy strategies that promote sectoral diversification and deeper economic engagement between the regions. **Keywords:** India-GCC trade, gravity model, remoteness index, multilateral resistance, export determinants

INTRODUCTION

The countries of the Gulf Cooperation Council and India have had a long-growing trading relationship over the years. This can be evidenced by the level of trade between India and the United Arab UAE, this reason makes India trade most with the GCC. Moreover, the formation of the Gulf Cooperation Council in 1981 and the start of the Greater Arab Free Commerce Agreement in 1997 explored enhanced linkages and interaction among the GCC countries which strengthened the bilateral trade relations effectively. To evaluate the export performance, the gravity model with remoteness indices has been used for India's export to GCC nations in the article. This model also predicts future trade that might be facilitated between India and the GCC countries by using predictors such as Gross Domestic Product, exporter and importer remoteness indexes, distance, and other related bilateral trade coefficients. Based on the central mass and distance, the models therefore distinguish the third-country effects and the multilateral resistance in trade contrary to the simple gravity model. This further reduces the problem of omitted variables whereby Bias in trade explanation is improved especially for geographically distant nations. It brings a remoteness factor which makes the model closer to modern conventional ideas about trade cost and market access accentuating relative trade costs. Evaluations of the empirical empiricism demonstrate that this method provides superior predictive accuracy and a closer approximation to empirical data. Simply distance and economic size do not

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constitute the complex geography that is embodied in the global trading system, this is where the remoteness index helps the model to take spatial form more comprehensively. Therefore, the model with remoteness index addresses these shortcomings and provides us with a more detailed method of looking through global trade distribution. In our paper, following (Pal & Kar, 2021), we incorporate remoteness into the analysis of the gravity model of international trade. Below, is the definition of remoteness. It is one of the reasons why the two partner countries are competitive with the other partner countries in the world trade system.

A country's economic growth and development depend heavily on trade, and economists and policymakers need to be aware of the factors that influence trade flows. Because of their proximity and complementary economies, India and the countries of the Gulf Cooperation Council (GCC) have established robust business ties. India's exports to GCC countries are not exceptional in that a country's export performance is significantly impacted by trade expenditures or expenses. A number of factors, including tariffs, transportation expenses, non-tariff obstacles, and administrative procedures influence India's trade costs. However, in nations like India, the cost of shipping goods outside has grown to be a major worry due to the huge increase in the amount of exported commodities. We refer to these expenses as trade costs. According to (Anderson & Wincoop, 2003), trade costs are any expenses involved in delivering commodities to a final consumer that are not related to the cost of manufacturing.

Trade cost affects both landlocked countries and countries with sizeable coastal lines, like India. On the other hand, some reports demonstrate that global trade expenses have decreased. Reduced transportation and communication costs have made international trading easier, as the World Trade Organization (2008) reported.

REVIEW OF LITERATURE

India's trading relations with the Gulf States, particularly those that are members of the Gulf Cooperation Council (GCC), have been the subject of numerous studies. With a present trade nexus of over $100 billion, (Das & Pradhan, 2014) highlighted the evolving dynamics of trade between India and the Gulf. Despite this growth, India's trade structure remains narrowly focused on a few conventional goods, prompting a need for further diversification. The authors identified potential areas for diversification based on the development and growth of specific industries where India holds a comparative advantage over the Gulf countries. They also provided a general overview of macroeconomic trends in both regions, highlighting the value and possibilities for bilateral trade. (Pethiyagoda, 2017) paper delves into the strategic aspects of India-GCC relations, emphasising the role of economics, trade, and migrant labor in driving the relationship. The author anticipates that strong trade ties will benefit both parties, prompting New Delhi to consider the strategic dimensions of the relationship. The paper examines India's goals to strengthen its standing as a major trading nation, weighing the benefits, drawbacks, and competitiveness in the changing market. used the Panel Gravity Model to examine how trade between India and the GCC changed between 2001 and 2015 (Alam & Ahmed, 2018). While geographic distance was a problem, their studies indicated tremendous trade potential, emphasising economic aspects like size, structure, and trade openness as well as binary characteristics like trading affinity and diaspora as facilitators. The study recommended the elimination of trade restrictions and dummy variables. (Yadav & Yadav, 2017), utilised the Balassa Index to assess bilateral economic trade interactions between India and Bahrain. Through trends, trade composition, and the trade intensity index, they examined the strength of the bilateral trading relationship and took note of the repetitive pattern of disclosed comparative advantage. Potential export markets for India that could increase interest in Bahrain were highlighted by the study. (Goyal & Abdul, 2016) offered suggestions for enhancing trade while concentrating on the amount and makeup of bilateral trade between India and the UAE. According to their analytical analysis, India and the United Arab Emirates are continuously working to improve their economies and global trade relations. Research by (Sahib & Kari, 2012) looked at intraregional commerce in the GCC and found that there was little concentration and a significant reliance on revenue from oil exports. Positive signals for Saudi Arabia and the UAE indicated favorable aspects in their non-oil sectors. (Alam & Ahmed, 2017) study investigated the UAE's role as India's top trading partner, emphasising re-exports and exploring potential products for trade growth. The bilateral trade connection between India and the GCC countries was examined by (Oommen & Imam, 2011), who also evaluated the political commitment to improve trade relations as well as trends and patterns. To identify products with a competitive advantage and analyse the effects of tariff reductions using partial equilibrium, (Ayyub & Manral, 2017) investigated trends and patterns of India's agricultural exports to the GCC. (Baldwin-edwards, 2011) looked at the historical facts and results of the Kafala system,

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highlighting how it contributed to inconsistencies in foreigner employment, migration, and residency throughout the GCC. Analysing the parallels and differences between the GCC's immigration and labour markets was the paper's conclusion.

"The gravity model of trade has demonstrated exceptional application in a variety of scenarios. It is extensively used to analyse bilateral trade flows based on economic size and geographic distance. Research by (Sultan et al., 2015) and (Cinar, Johnson, and Geusz, 2016) highlight its efficacy in both developed and emerging economies. Using this model, (Irshad et al., 2018) investigated the dynamics of trade between China and OPEC nations, demonstrating the beneficial effects of economic factors and the detrimental effects of geographic distance. (Magrini et al., 2017) showed notable sector-specific effects while concentrating on EU trade preferences in Southern Mediterranean countries. Furthermore, (Bialynicka-Birula, 2015) confirmed that one of the main factors influencing trade intensity in nations that make up the European Community is distance. Studies by (Boughanmi, 2008) on free trade agreements and (Efthymiou, 2013) on geopolitical factors demonstrate how the gravity model has also clarified trade relations involving GCC nations. Collectively, these studies demonstrate the model's flexibility in assessing and forecasting trade trends, providing vital information for decision-makers navigating global trade dynamics." The technological variables are added to the traditional gravity model because, as recent literature has shown, these variables are important and significant as determinants of trade flows (Caroline & Diana, 2015). Additionally, a remoteness variable is included (Márquez-Ramos et al., 2007). Additionally, a more adaptable model that considers variation in the slope coefficients based on income levels is computed.

OBJECTIVES

Using the gravity model of international trade combined with remoteness indicators, a thorough study of India's export dynamics with the Gulf Cooperation Council (GCC) nations will be carried out. Finding, measuring, and interpreting the major variables that affect bilateral trade flows—such as economic size, geographic distance, trade costs, historical and cultural links, and policy frameworks—is the goal of the study. With remoteness indices, the study aims to provide a better understanding of how regional trade networks and geographic economic ties impact India's export performance to the GCC region by capturing the relative accessibility or isolation of trading partners in the global market.

METHODS

Sample description and data

India and the six GCC nations—Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates—make up the sample.

Series of Data: data every year between 1996 and 2023.

Data sources: Books, journals, studies, working papers, newspapers, and the International Trade Statistics statistical database from WDI, WTO, UNCTAD, ITC, IMF, Ministry of Commerce, and other official websites of the Government of India and GCC will all be used by the researcher to gather secondary data.

Tools to be Used: Gravity Model of Trade

(Ravenstein, 1885) and (Zipf, 1946) were the first figures in the nineteenth century to apply the gravity equation. However, (Tinbergen, 1962) and (Pöyhönen, 1963) were the first to use the model formally. of diverse commodities under varied circumstances, the gravity model has acquired widespread employment in recent decades despite early criticism that it is theoretical (Deardorff, 1984). This approach was first applied to international trade in 1962 by J. Tinbergen. The gravity model of commerce forecasts bilateral trade flows between two locations that are inversely proportional to their distance from one another and directly related to the product of economic size (often measured by GDP or GNP), much like the universal Newtonian gravity model. Since distance serves as a stand-in for trade costs in this context, an increase in trade costs will have a detrimental impact on bilateral trade as the distance between two locations grows.

Gravity model estimation with Remoteness Indexes

The multilateral resistance factors are not taken into consideration by (Anderson & Wincoop, 2003) since doing so could result in significant distortions in the estimate of gravity model variables. "REMOTENESS" is a proxy for these indices, and it is a commonly used technique to control the multilateral resistance terms for both importing and exporting countries. This use of the remoteness indicator in the gravity trade equation computation is similar to that of (Anderson & Wincoop, 2003) and (Coe et al., 2002). The average distance between a nation and its trading partners is determined by the remoteness index, which is used in this study. The gravity variables equation for multilateral resistance terms with the help of remoteness index are as follows: -

- **Ln REM_EXP$_{i, t}$: - $\sum$j Dist$_{ij}$ / (E$_{j, t}$/ Y$_t$)**

- **Ln REM_IMP$_{i, t}$: - $\sum$j Dist$_{ij}$ / (Y$_{i, t}$/ Y$_t$)**

Whereas E$_{j, t}$ is GDP of importer, Y$_t$ are the partner countries' shares of world GDP and Y$_{i,t}$ is the GDP of Exporter in respect of time and Y$_t$ are the partners country shares of world GDP. (Anderson & Wincoop, 2003) took a purely theoretical approach to develop a Structural Gravity Model that successfully addresses this type of issue by including Multilateral Resistance Terms (MRTs) that relate to trade costs.

Augmented Gravity Model Equation: -

Log (EXP$_{ijt}$) = β_0 + β_1 Log (GDP$_{it}$) + β_2 Log (GDP$_{jt}$) + β_3 Log (REM_EXP$_{i,t}$) + β_4 Log (REM_IMP$_{j,t}$) + β_5 Log (Dist$_{ij}$) + γ_1 (comcol) + γ_2 (comlang_ethno) + u$_{ij}$

Where i refers country i (India), j refers country j partner country (each member of GCC) and t refers time period (year).

Table 1: Variables, Definitions and Data Sources

S.no	Variables	Definitions	Data Sources
1	**Exports$_{ij}$**	Total exports from the countries of origin to the countries of destination.	UNCTAD, ITC
2	**Ln Exports$_{ij}$**	Total exports from the source to the destination nations, expressed in natural logarithm form.	Calculated by the researcher
3	**GDP$_i$**	The source country's nominal GDP in US dollars	WDI and World Bank
4	**Ln GDP$_i$**	nominal GDP in US dollars, expressed in natural logarithmic form for the source nation i	Calculated by the researcher
5	**GDP$_j$**	Nominal GDP in US thousand Dollars in sources country j	WDI and World Bank
6	**Ln GDP$_j$**	Nominal GDP in US thousand Dollars in sources country j, in natural logarithm form	Calculated by the researcher
7	**REM_EXP$_{i,t}$**	Output and expenditure weighted average of bilateral distance on exporter side	Calculated by the researcher
8	**REM_IMP$_{j,t}$**	Output and expenditure weighted average of bilateral distance on exporter side on importer side	Calculated by the researcher
9	**Ln REM_EXP$_{i,t}$**	Output and expenditure weighted average of bilateral distance on exporter side, in natural logarithm form	Calculated by the researcher
10	**Ln REM_IMP$_{j,t}$**	Output and expenditure weighted average of bilateral distance on exporter side on importer side, in natural logarithm form	Calculated by the researcher
11	**DIST$_{ij}$**	The geographic separations (miles) between the nations of origin and destination	CEPII
12	**Ln DIST$_{ij}$**	The geographic separations (miles) between the nations of origin and destination in natural logarithm form	Calculated by the researcher
13	**Comcol**	country i and country j were colonies with the same coloniser than it will be one otherwise zero after 1945	CEPII

14	**Comlang_ethno**	country I and Country j do share a common language spoken by at least 9% of the population	CEPII
15	**Uij**	This is a log-normally distributed error term representing the myriad other influence on bilateral trade.	

RESULTS

The gravity model which is regressed to its simplest form also shows the positive connection between the GDPi of exporters and exports. They found that exports increase by 0.83 per cent for every one per cent change in GDP. The GDP exporter coefficient is equal to 0.839313 which is significantly less than $P < 0.05$. Following the general rule, the results show that the null hypothesis should be rejected if the p-value of a variable is equal to or less than 0.05 Hence, it could be concluded that GDP exporters have a significant impact on the exports between India and the GCC. Consequently, the probability and coefficient of the GDP exporter show that the GDP exporter affects trade substantially. It was noted that the GDP importer variable, GDPj, influenced export flows between India and GCC countries. Exports were up by 0.70% constantly improving than the 1% in GDPj of GDP. The results show that the GDP importer variable per capita also has significant effects on the trade of India and GCC nations as it has a value of 0.7065 and a p –p-p-value of 0.00. This tends to explain that the probability and coefficient of the GDP importer denote how it influences trade.

It was also concluded that distance was a negative motivating factor on dependent variables such as trade and export between India and the GCC nations. The above results give the estimated coefficient value of distance (Lndistij) of -3.844911, which is a negative sign that shows a negative association with exports. A one per cent rise in distance would reduce exports by 3.84 per cent. Another test to show the relationship between distance and costs is the p-value, which is less than the significant level (0.00<0.05). The bilateral trade of India is affected due to the declining bilateral commerce of the GCC countries. The second hypothesis was supported, while the first hypothesis was rejected. The negative effect that comes from it is the trade and transport cost which has a wider effect on international trade than the manufacturing cost. Other costs affected by changes in the price of oil for example costs of trade and transportation are also affected.

For instance, price changes gave way to other shifts such as the effect of oil price hikes in 1973 and 1980 and the distance travelled (Schiff & Carrere, 2003). This study also contains two dummy variables for the gravity model specification and exports, and the common colony have a positive relationship. A positive effect on exports is highlighted by the sign of the dummy variable which is 1.1167, as postulated in the theoretical idea of the model.

The findings of this research are negative for the export variable and comlang_ethno, a dummy variable and Indian exports to GCC nations. According to the proposed model, the coefficient of determination is desired to be high (0.81) to means that 81% of changes in the dependent variable are accounted for by the independent variables. Geographical distance or isolation, represented by the exporter remoteness index and the importer remoteness index, have negative coefficient estimates and therefore are negatively related to exports. Hypothesis 3: Increased remoteness indices imply that one or both parties will face a higher level of transport costs or endeavours, an element which can impair trade flow. While undertaking a gravity model with a remoteness index it was observed that bilateral trade flow between India and GCC countries is determined positively by both GDP and a dummy for common colony. Nonetheless, it bears a direct relationship with a distance of two sides, the exporter remoteness index, importer remoteness index, and common language ethno.

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Table 2: Result of Gravity model with remoteness

Variables	Coef.	Std. Err.	P value
ln_GDPexp	0.8371304	0.0677356	0.00
ln_GDPimp	0.7051907	0.0672766	0.00
ln_dist	-3.85094	0.3507116	0.00
Comcol	1.11624	0.106239	0.00
Comlang_ethno	-0.7327251	0.1351482	0.00
ln_REM_EXP	-0.4880476	0.100394	0.00
ln_REM_IMP	-0.7055838	0.1000136	0.00
_cons	27.20113	4.367589	0.00
Number of obs	199		
R-squared	0.8184		
F (7, 191)	122.96		
Prob > F	0.00		
heteroskedasticity	0.58		
Mean VIF	2.99		
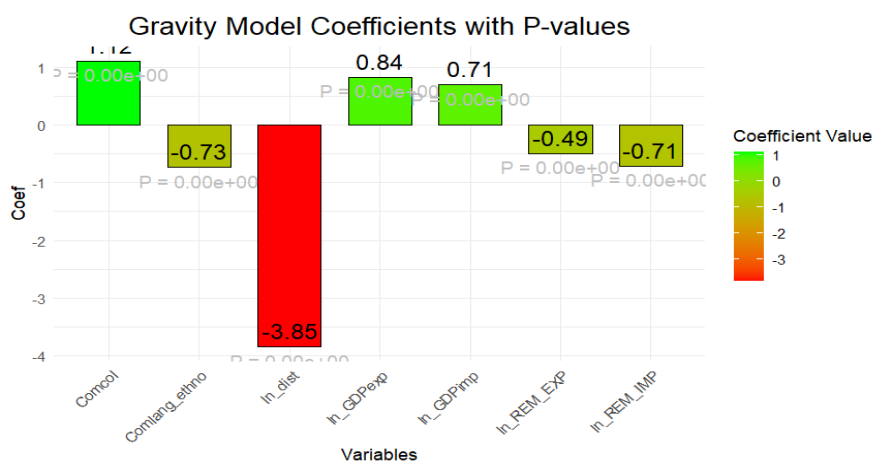
Graph 1: Result of Gravity model

DISCUSSION

The following findings derived from the analysis of the data in this research provide insights into the factors that affect exports to India's GCC countries: An account of the extent to which different explanatory factors are related to the exports, which serves as the dependent variable in the equations, is made comprehensible by the PPML approach applied to the gravity model equation. First, the study shows that export has a strong and positive relationship with the GDP of the exporting country, GDPi and GDP of the importing country, GDPj. It is clear from the positive coefficient for GDPi that the exporting country 's GDP goes up in step with the exports. A coefficient less than one indicates that there may be an imperfect ratio and that, with large sizes of economy, exports are a little less than a proportionally larger amount. Likewise, the result implies that the coefficient estimate for GDPj is positive meaning

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exports are affected by a surge in the importing nation's GDP, but the impact is far smaller than proportional. This study also gives us a low down on population size showing a direct and significant relationship between exports on the two variables namely POPj; the imports and Popi; the exporters. This implies that as the population increases, export levels for the exporter as well as the importer also increase, which underlines the importance of market size in the promotion of the business between the two regions: India and the GCC nations. The projection also introduces the impact of the distance between India and the GCC nations on exports. Consistent with theoretical expectations, the coefficient of distance variable or (Lndistij) is negative implying that exports reduce with trading partner distance. This is consistent with the expectations as the distance was adopted as a measure of transportation cost and indeed a one per cent increase in distance reduced export by 2.95 per cent of countries. A particular emphasis is made on transport costs as the major aspects shaping trade relationships between India and the GCC countries, which are measured in terms of distance. Pseudo variables are also used as control variables to tap the historical and cultural endowments among the nations. Export and the common colony variable (control) has a probability value < 0.5 which denotes a positive correlation between trade and previous colonial connections. On the other hand, and based on Table IV, evidence of a statistically significant and negative sign for the comlang_ethno implies that common ethnicity and language are harmful to export flows. Such outcomes demonstrate how complicated and interconnected are historical cultural factors with trade relations.

CONCLUSION

The present work aims to provide a critical look at the export of India to the members of the GCC with a view of highlighting the results that will enlarge the existing literature on the export of this economy to this partner. By using a more accurately defined advanced gravity model methodology that includes remoteness indices, this paper also supports the conventional factors of the gravity model and sheds new light on how history connection and international antagonism impact trade flows. Thus, by the R-squared of 0.8184, the model has excellent explanatory crushing factors involvement detailed interaction of Commerce between India and GCC. It was revealed that the economic size export relationship is positive for both exported and import as measured by GDP with elasticity of 0.84 for India and 0.71 for the GCC countries. On the other hand, distance poses a great challenge to trade, whereby a $ 1% increase will lead to a massive $ 3.85% reduction in exports. This goes to show that touch physical contact and transportation costs remain critically important in international commerce. Contrary to expectation, the common language ethnicity coefficient has a negative sign in the export regression, while the sign on the common colony variable is positive. It can also be observed from this analysis several interesting mechanisms in connection with historical and cultural contacts. Moreover, the introduction of remoteness indices for importers and exporters provides new valuable insights into the impact of multilateral resistance to show how trade flows can be affected by geographical isolation. In the manufacturing, industrial, and agricultural fields, a sectoral analysis shows that concentration can be observed in specific commodity categories, which can point to potential future export specialization. They indicate that greater concerted efforts at reducing trade costs, upgrading transportation and communication, and building on past links may indeed open much larger bilateral trade.

As stated in the literature these findings have profound implications for policymakers and enterprises involved in India-GCC trade relations. Third, pinpointing the leading export industries offers a guideline on the appropriate intra-industry trade promotion and diversification plan. As the global environment is shifting, the trade between India and the GCC countries will only strengthen in the future, and the findings of this research will be valuable in helping businesses and policymakers make decisions that can enhance trade relations' benefits.

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