An Empirical Application of Gravity Model Theory to Indo-BIMSTEC Business Relations

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This paper applies the Gravity Model Theory (Tinbergen 1962) to assess the impact of determinants on the Indo-BIMSTEC trade and trade potential for the sample of six countries, over the period 1997-2019. The study also examines the application of Heckscher-Ohlin (1933) and Staffan Linder (1961) and J.H. Bergstrand theories (1989) using the variables GDP per capita Differential and GDP per capita of India and BIMSTEC countries respectively. The estimate of Hausman Specification test suggests that fixed effect gravity model is to be preferred to the random effect gravity model. The study reports that GDP is consistence and Distance is inconsistent with the hypothesis of basic gravity model, however, the insignificant *p-values* do not support the proposition and market size of BIMSTEC countries has negative and insignificant impact on trade. The finding reveals that there is presence of convergence in INDO-BIMSTEC trade, which indicates that India has trade potential with Bhutan, Nepal, Sri Lanka and Thailand. Further, the study confirms that China's increasing trade with BIMSTEC countries is threat to the INDO-BIMSTEC trade relations as increase in the China's trade with BIMSTEC countries will tend to decrease the India's trade with BIMSTEC countries. The study suggests that India's promising business relations with BIMSTEC countries will make her position strong in the current world order.

***Keywords*:** Gravity Model, INDO-BIMSTEC, Trade, Trade Potential, Fixed Effect Model.

Regional co-operation whether market driven, or policy induced is a medium of economic integration. Free trade maximises global welfare, but such ideal state is impossible due to many distortions which leads to economic regionalism (Kabir & Salim, 2010). Economic regionalism has gained increased prominence due to failures of multilateral negotiations under the aegis World Trade Organisation. In the quest of development and economic integration most of the nations of world are members of one or more regional blocs. Thus, regional economic co-operation has become a dominant feature of the global economy. Consequently, Indian policy regime has been adapting these collaborative measures to restore her historical and socio-cultural links with the immediate and extended neighbourhood (Sharma & Rathore, 2015) to integrate economically.

In the backdrop of a failing SAARC, to combine the "Look West Policy" of Thailand and ASEAN with "Look East Policy" of India, realise the goal of a liberalised economy and counter China's imperialist design in the region, India felt the need to step-up her political, strategic, and economic engagement with neighbouring countries (Mohan, 2016). The Bay of Bengal Initiative for Multilateral Technical and Economic Co-operation (BIMSTEC) was formed at a meeting in 1997 in Bangkok with four founding members: India, Bangladesh, Sri-Lanka and Thailand, and later joined by Myanmar in December 1997 and by Nepal and Bhutan in February 2004. The primary objectives of BIMSTEC were to impart greater economic co-operation in the areas of technology, transport, communication, climate change, energy, tourism, agriculture, fisheries, disaster management and human resource development. In addition to these areas BIMSTEC took initiative to strengthen the economic co-operation in the field of trade and investment (Banik, 2007). The higher level of economic co-operation with BIMSTEC nations will lead to large market, scale of economies in production and improved resource allocation with advance technology.

BIMSTEC is home to 1.70 billion people which is approximately 22.21 percent of world population (World Bank) in 2019 with 3.64 percent of surface area. Region is characterised by heterogeneity of income

among the member countries, having a combined GDP of US$ 3914.94 billion which is 4.46 percent of global GDP. Table 1 reports that India is the biggest economy in terms of GDP while Bhutan is smallest among the BIMSTEC countries; in between the two, only Thailand and Bhutan can be noticed as dominant nations. Though the economy size of India is larger than the combined economy size of other BIMSTEC countries, from the diplomatic, strategic and geo-political perspective, strong and healthy relations with immediate neighbouring countries are very important as the success of BIMSTEC will contribute to the improve the position of India in current world order.

TABLE 1: Economy Size of BIMSTEC (Value in US$ Billions)

Years	*Bangladesh*	*Bhutan*	*India*	*Sri Lanka*	*Myanmar*	*Nepal*	*Thailand*	*BIMSTEC*	*World*
1997	48.24	0.37	415.87	15.09	9.04	4.92	150.18	643.71	31458.07
per cent In Global GDP	0.15	0.00	1.32	0.05	0.03	0.02	0.48	2.05	100.00
2019	302.57	2.84	2875.14	84.01	76.09	30.64	543.65	3914.94	87751.54
per cent In Global GDP	0.34	0.00	3.28	0.10	0.09	0.03	0.62	4.46	100.00
CAGR	**8.70**	**9.76**	**9.19**	**8.12**	**10.17**	**8.67**	**6.02**	**8.55**	**4.77**

Source: Data retrieved from World Bank Data Base on 20 October 2020.

FIGURE 1: Trends of Economy Size of India and BIMSTEC (1997-2019)

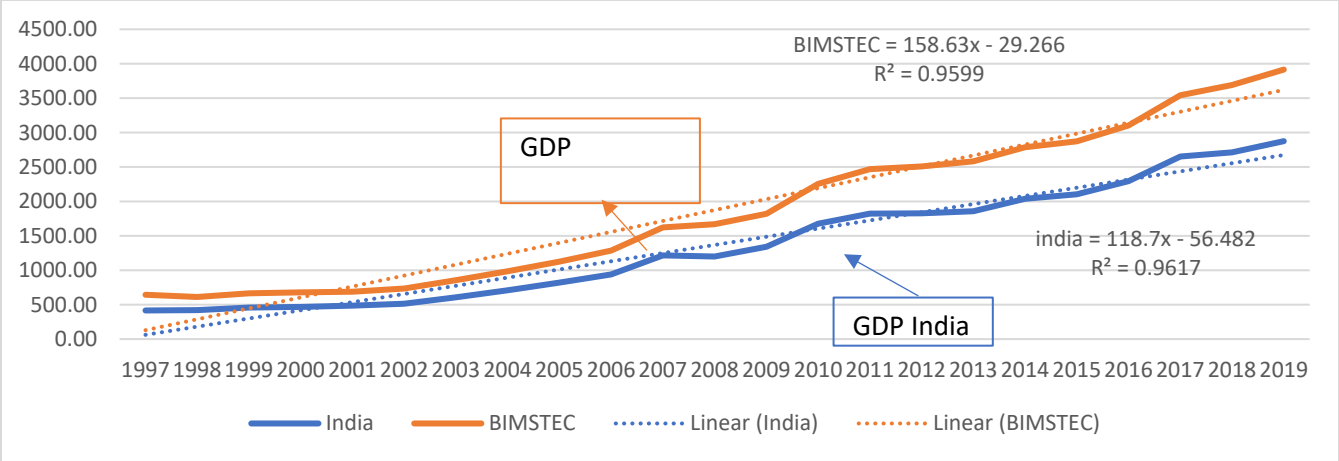

Figure 1 shows the trends of GDP of India and BIMSTEC countries. The trends of GDP India and BIMSTEC countries are reflecting the increasing tendency. Table 2 presents the analysis of India's trade performance with BIMSTEC countries in terms of trade, exports, and imports. India's trade with BIMSTEC countries was 3.44 percent in 1991 which increased to 4.49 percent in 2019. India's trade was highest with Thailand followed by Bangladesh, Nepal, Sri-Lanka, Myanmar and Bhutan. India's exports to BIMSTEC counties were 5.48 percent in 1991 and which increased to 7.81 percent in 2019. India's imports from Bangladesh were maximum followed by Nepal, Thailand, Sri-Lanka, Myanmar and Bhutan. India's imports from BIMSTEC counties were 1.54 percent in 1991 and which increased to 2.24 percent in 2019. India's imports from Thailand were maximum followed by Bangladesh, Sri-Lanka, Nepal, Myanmar and Bhutan. The analysis of compound annual growth rate (CAGR) of India's trade with BIMSTEC countries reveals that India's trade performance with Nepal is strong while weak with Myanmar. Therefore, the analysis confirms that among the BIMSTEC, Thailand, Bangladesh, Sri-Lanka and Nepal are major trading partners of India.

TABLE 2: Analysis of India's Trade Performance with BIMSTEC Countries (Value in US$ Million)

India's Trade with BIMSTEC Countries								
Years	*Bangladesh*	*Bhutan*	*Myanmar*	*Nepal*	*Sri-Lanka*	*Thailand*	*BIMSTEC (per cent of India's Global Trade)*	*India's World Trade*
1997	860.78	33.98	260.58	256.35	520.20	594.05	2525.93 (3.44per cent)	75518.50
2019	9340.73	936.26	1485.50	7717.96	5310.51	11335.78	36126.75 (4.49per cent)	804629.98
CAGR	11.45	16.27	8.23	16.74	11.14	14.34	12.85	11.35
India's Exports to BIMSTEC Countries								
1997	807.13	15.48	48.28	168.93	486.25	369.78	1895.83 (5.48per cent)	34622.08
2019	8121.29	691.73	945.61	7076.24	4270.47	4296.33	25401.67 (7.81per cent)	325145.60
CAGR	11.06	18.85	14.48	18.50	10.38	11.79	12.52	10.72
India's Imports from BIMSTEC Countries								
1997	53.65	18.50	212.30	87.43	33.95	224.28	630.10 (1.54per cent)	40896.43
2019	1219.44	244.53	539.89	641.73	1040.05	7039.45	10725.09 (2.24per cent)	479484.38
CAGR	15.26	12.45	4.33	9.48	16.83	16.96	13.75	11.84

Source: Data retrieved from IMF on 20 October 2020.

FIGURE 2: India's Trade, Exports and Imports with BIMSTEC (1997-2019)

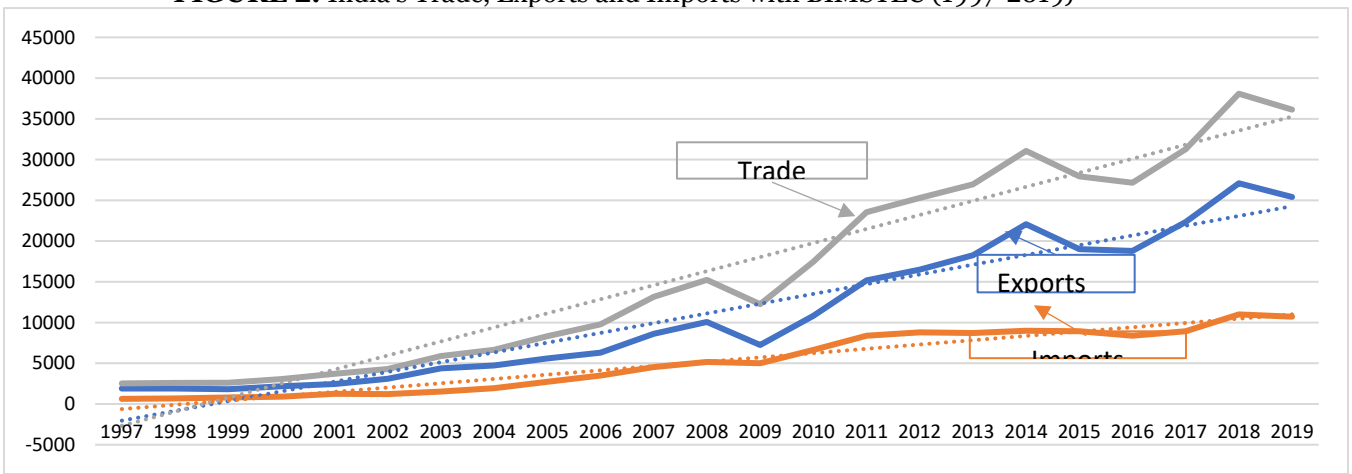

Figure 2 shows the trends of India's trade, exports and imports performance with BIMSTEC countries from 1997 to 2019. The trends of trade, exports and imports performance is reflecting the increasing tendencies.

Literature Review and Statement of the Problem

This section deals with the review of previous studies relating to empirical analysis of bilateral trade flows between the nations in the backdrop of Gravity Model. Alam, Uddin & Tauffique (2009) employed the gravity model to analyse the Bangladesh's imports flows with its eight major partner countries namely India, China, Singapore, Japan, Hong Kong, South Korea, United States of America (USA) and Malaysia from 1985 to 2003. The results of the gravity model indicated that the GDP of Bangladesh, Distance and Population of trading partner countries have negative and significant impact on imports. The values of coefficients of GDP of partner countries and population of Bangladesh have positive and significant effects on Bangladesh's imports flows. Kaur and Nanda (2011), in their Gravity Model analysis of Pakistan's exports potential with SAARC countries over the period from 1981 to 2005, on the basis of fixed effects model, reported that the Population of Pakistan had a positive and significant impact on its exports to SAARC countries. The GDP and Real Exchange Rate of Pakistan and Per Capita Difference had positive and non-significant impact whereas GDP, Population and Real exchange rate of SAARC countries had negative and insignificant impact. The fixed effect estimates relating to Language and Border were found positive and insignificant and coefficient on Distance carried negative and insignificant impact. The study also confirmed that Pakistan had export potential with Bhutan, India, Maldives and Nepal and there was a presence of convergence of Pak's exports with SAARC countries.

Oh and Prasai (2012) investigated Nepal's exports and imports patterns with 94 trading partners using the gravity model with random effects estimates over the period 1981-2009. In case of exports, the coefficient of product of GDP was positive and significant. The coefficient on GDP Per Capita, Landlocked, and WTO were negative but insignificant, while Linder effect and SAARC coefficients were positive but insignificant. The coefficient on Distance was negative and significant which represents expected sign. Regarding imports, the coefficient on product of GDP, Linder effect, SAARC membership and WTO membership have a positive and significant effect while GDP per capita, Distance and landlocked have negative and significant effect. Roy and Rayhan (2012) evaluated the determinants of Bangladesh's import flow from India, Nepal, Sri-Lanka, Indonesia, Malaysia, Singapore, Thailand, Canada, USA, France, Germany, Kuwait, and Saudi Arabia with the help of augmented gravity model for the period 1991 to 2007. The study found that coefficients of GDP of Bangladesh, GDP of partner countries, Exchange Rate, and Boarder have positive and significant impact on Bangladesh's imports flow whereas, Distance has negative and significant impact on imports. Dummy variable SAARC has negative but insignificant impact on Bangladesh imports. Iqbal and Islam (2014) analysed Bangladesh's bilateral exports with European Union for the period 1980 to 2010 employing Gravity Model. The estimated results indicate that GDP of Bangladesh have positive and significant effect on exports, but GDP of the European Union and real exchange rate have negative and significant effect on exports. The estimated coefficient of distance has negative sign with insignificant effect on bilateral exports flow.

Kumar and Ahmed (2015) pointed out the determinants of exports and imports flows of countries in the South Asia by employing a gravity model over the period 1985-2011. The results of augmented gravity model have suggested that the size of GDP and Population among other factors have positive effect on export and import flows whereas Distance and Tariff have negative effect. Nobinkhor (2015) examined the relationship between the trade balance of Bangladesh with BRICS countries by applying gravity model (1991-2013). The findings of the study confirmed that GDP and Distance have negative and significant effect on Bangladesh's balance of trade whereas Per Capita GNI and Exchange Rate have positive and significant effect on trade balance. Lai and Bujang (2016) used the gravity model to analyse the Malaysian seaports flows with six major trading countries like Singapore, China, Japan, United States of America, Thailand and Hong Kong from 1995 to 2012.The estimated results indicated that the value of coefficients of GDP Per Capita of partner countries, Trade Openness of partner countries, Population of Malaysia have positive and significant effect while GDP Per Capita Differential, Inflation Rate of Malaysia, Exchange

Rate and Distance have negative effect on Malaysian's exports. The study found that GDPPC of home country, Inflation Rate of partner countries, Unemployment of both Malaysia and partner country, Trade Openness of Malaysia and Population of partner countries have expected sign but insignificant values. The analysis supported the Linder hypothesis, stating that Malaysia will trade more with nations who have similar levels of development since they have similar demand but distinct products.

Alam & Ahmed (2018) studied determinants of India-GCC export flow with the help of augmented gravity model for the period 2001 to 2015.The results of augmented gravity model have suggested that the coefficients of GDP of India, GDP of GCC, Population of GCC, Import Openness, Common Colony, Diaspora have positive and significant effect on export, but population of India and common language are insignificant whereas Distance and Tariff have negative effect on exports. Dhami, Wani & Sidana(2020) analysed India's trade potential with BRICS employing the Gravity Model for the cross-sectional data of two years specifically of 1995 and 2016. The estimated results revealed that GDP, per capita GDP, Trade-GDP ratio have positive and significant effects on India's bilateral trade with BRCS countries whereas RTA's has positive but insignificant effect on trade. As expected, Distance has negative and significant impact on India's bilateral trade flows. The per capita GDP Differential has a negative coefficient which supported the Linder hypothesis stating, countries with similar economic level of development trade more as compared to dissimilar level of economic structure. On the basis of review of literature of various studies, it is observed that there is lack of comprehensive study on India's bilateral trade flows with BIMSTEC countries using the Gravity Model analysis.

Research Methodology and Model Specification

Consequent upon the review of previous studies and title of the paper, the following objectives were developed to fill the research gap: to evaluate India's trade performance with BIMSTEC countries, to identify determinants which influence India's trade with BIMSTEC countries using Gravity Model Theory and to examine which of the two theories of trade i.e., Heckscher-Ohlin and Staffan Linder theory is applicable in case of INDO-BIMSTEC bilateral trade flows.

Hypotheses of the Study Corresponding to the objectives of the study, the following hypothesis were formulated: -

1. H01: There is no significant impact of independent variables on India's trade with BIMSTEC countries.
2. Ha2: Variables $\beta_{2;}$ $\beta_{5;}$ $\beta_{4;}$;$\beta_{7;}$ $\beta_{8;}\beta_{9;}$ $\beta_{11;}\beta_{13;}\beta_{14}$ and β_{15} have positive impact on India's trade with BIMSTEC countries.
3. Ha3: Variables $\beta_{3\ and}$ β_{12} have negative impact on India's trade with BIMSTEC countries.
4. Ha4: Variables $\beta_{3:}$ $\beta_{6,}$ and β_{10} and may have negative or positive impact on India's trade with BIMSTEC countries. The positive coefficient of β_9 shows similar countries trade less than dissimilar ones which support the Heckscher-Ohlin hypothesis whereas, negative value of coefficient explains that similar countries trade more than dissimilar ones which support the Linder Hypothesis

Scope of the Study The present study is conducted to investigate India's bilateral trade flows and trade potential with BIMSTEC over the period of 23 years i.e., from 1997 to 2019. The study is casual and empirical, which is based on secondary sources of information. There are various dimensions of economic relations such trade, investment, tourism, technological co-operation etc., but the current research work studied only India's trade relations. The various software like MS-Excel, SPSS and STATA were used for the purpose of analysis.

Source of Data The nominal value of bilateral trade data has been obtained from IMF. The data related to GDP of India and BIMSTEC, Population of India and BIMSTEC, Trade openness of India and BIMSTEC, has been collected from World Bank. While data related to Distance and Language obtained from Centre for Prospective Studies and International Information (CEPII, France). Data of Exchange Rate and FDI are obtained from UNCTAD Stat. The data related to Terms of Trade and Trading Affinity has been collected from IMF.

Model Specification The Gravity Model as proposed by Tinbergen (1962) and Poyhonen (1963) is applied for estimating India's bilateral trade flow and trade potential with BIMSTEC countries along with

identifying the determinants of bilateral trade flow. The classical Gravity Model is based on the hypothesis that "trade is directly proportionate to GDP and inversely proportionate to distance" The equation of basic gravity model as given by Tinbergen (1962) and Poyhonen (1963) is presented as under:

$$\boldsymbol{T_{ij} = a + \frac{GDP_i GDP_j}{D_{ij}^2}} \text{..... (1)}$$

Where, $T_{ij}$is the trade flow from origin *country*$_i$ to destination *country*$_j$; A is a constant term; GDP_i and GDP_j is the gross domestic product of country *I* and *j*; and D_{ij} is the distance between country i and j. Taking log of the both side of equation (2), we get: -

$$\text{Ln } T_{ijt} = \ln A + \beta_1 \ln GDPit + \ln \beta_2 GDPjt - \beta_3 \ln Dij + \varepsilon ijt \text{ .....(2)}$$

The basic gravity equation (2) may be modified by adding some new variables to get Augmented Gravity Model Equation. In the present study the following Augmented Gravity Model equation has been used to analyse the significance of various determinants in estimating and determining the trade potential:

$$\text{Ln (Tijt)} = \alpha + \beta_1 Ln(\text{China trade}_{jt}) + \beta_2 Ln(GDPit * GDPjt) + \beta_3 Ln(Pop_{it} * Pop_{jt}) + \beta_4 Ln(GDPPC_{it}) +$$

$$\beta_5 Ln(GDPPC_{jt}) + \beta_6 Ln(\text{GDPPC Differentail}_{ijt}) + \beta_7 Ln(TOP_{it}) + \beta_8 Ln(TOPjt) + \beta_9 Ln(TOTjt) + \beta_{10} Ln(ERijt) +$$

$$\beta_{11} Ln(FDI_{it}) + uijt \text{.....}$$

Where, i = India; j= 1, 2, 3, … (BIMSTEC Countries); t = 1997-2019; L_n= Natural Logs

T_{ijt} Bilateral trade flows between India and country j in year t.

China Trade$_{jt}$ China trade with country j in year t. Expected Sign is negative.

GDP_{it}*GDP_{jt} The product of GDP of India and its trading partner countries in year t; (measured in US$ millions). Expected Sign is positive. (Alam & Ahmed, 2018; Alam, Uddin & Tauffique, 2009; Binh, Duong & Cuong, 2011; Chaudhary, Xiumin & Khan,2018, Dhami, Wani & Sidana, 2020; Iqbal & Islam, 2014; Kaur, 2012; Kaur & Nanda, 2011; Nguyen, 2014; Oh & Prasai, 2012; Pradhan, 2006; Zarzoso & Lehmann, 2003).

Pop_{it} *Pop_{jt} The product of population of India and its trading partner countries in year t; (measured in millions). Expected Sign is either positive or negative. (Alam & Ahmed, 2018; Alam, Uddin & Tauffique, 2009; Kaur, 2012; Kaur & Nanda, 2011;Kumar & Ahmed ,2015; Zarzoso & Lehmann, 2003, Rahman, 2003)

$GDPPC_{it}$ GDP per capita of India in the year t. Expected Sign is either positive or negative

$GDPPC_{jt}$ GDP per capita of country j in the year t. Expected Sign is either positive or negative

GDP Per Capita Differential$_{ijt}$ the absolute difference of per capita GDP between India and its trading partner countries in year t. Expected Sign is either positive or negative.

TOP_{it} Trade Openness of India with the World. Expected Sign is positive. (Chaudhary, Xiumin & Khan 2018; Sarin, 2018; Rahman, 2003 ; Zarzoso & Lehmann, 2003

TOP_{jt} Trade Openness of country j with the world. Expected Sign is positive.

TOT_{ijt} Terms of Trade of India with county j in the year t. Expected Sign is either positive or negative

ER_{ijt} Exchange rate between India and country j in year t. Expected Sign is either positive or negative. (Bergstand, 1985; Binh, Duong & Cuong, 2011; Chaudhary, Xiumin & Khan,2018).

FDI_{it} FDI is helps in improving the production capabilities which leads to higher trade flows. Expected Sign is positive.

u_{it} Error-term, which is assumed to be normally distributed with zero mean and constant variance for all observations and to be uncorrelated

In the present study to examine the impact of determinants over the India's trade with BIMSTEC countries, analysis has been conducted using the random effect model and fixed effect model. In the gravity model analysis the time invariant variables like Distance, Language, Diaspora and Trading Affinity have been taken. The problem with fixed effect model is that it can't directly estimate time invariant or static variables as the inherent transformation removes such variables. However, Hausman Specification test is applied to check the null hypothesis that random effect model is more appropriate than fixed effect model. In case null hypothesis is rejected then fixed effect model estimates will be considered for the analysis purpose. In such case, the time invariant variables can be estimated in the second step, running another regression with individual effect as the dependent variable and Distance and dummies like Language, Diaspora and Trading Affinity as independent variables(Egger, 2002;Egger & Pfaffermayr, 2003;Filippinin & Molini, 2003;Zarzoso & Lehmann, 2003; Rahman, 2003; Kaur & Nanda, 2011;Rahman & Dutta, 2012;Yasmin & Husain, 2015; Lai & Bujang, 2016)Thus the linear equation for second stage regression is as under:-

$IE_{ij} = \beta_0 + \beta_{12}\ln(\text{Distance}) + \beta_{13}(\text{Language}) + \beta_{14}(\text{Diaspora}) + \beta_{15}(\text{Trading Affinity}) + u_{it}$

Where:

IE = Individual Effect

Ln: Natural log

Distance: Therefore, the coefficient of distance is expected to be negative (Alam & Ahmed, 2018; Alam,Uddin & Tauffique,2009; Binh,Duong & Cuong, 2011; Chaudhary,Xiumin & Khan, 2018; Dhami,Wani & Sidana, 2020; Iqbal & Islam, 2014; Kaur, 2012; Kaur & Nanda, 2011; Nguyen, 2014; Oh & Prasai, 2012; Pradhan, 2006; Rahman, 2003 ; Zarzoso & Lehmann, 2003).

Language: it is expected that common language will help to improve trade negotiation and reduce the transaction cost Value 1 for language (official or commercial) Hindi or English and 0 for others have been taken. The coefficient of language variable is expected to be positive (Alam & Ahmed, 2018; Kaur, 2012; Kaur & Nanda, 2011; Kumar &Ahmed, 2015; Sarin, 2018; Rahman, 2003 ; Zarzoso & Lehmann, 2003).

Diaspora: if average number of Indian diaspora population in country j is more than one percent of the total population of country j for the period of 1997 to 2019, the dummy variable value will be one otherwise zero. (Alam & Ahmed, 2018).

Trading Affinity: This dummy is created on the basis of countries those have an average of more than one percent share in India's total trade for the period 1997 to 2019 continuously would have a value of 1 and 0 otherwise. The expected coefficient of trading affinity is to be positive. (Pradhan, 2006).

Point Estimated Method: In this method, potential trade has been compared with the actual trade to consider whether the flows of bilateral trade between two countries have been overused or underused. Hence, point estimated method is divided into two methods namely Difference Method and Ratio Method. However, in the present study trade potential is computed using the ratio method only i.e., the ratio of predicted trade flows (P) to actual trade flows (A). If the ratio (P/A) exceeds one, there is an implication in terms of potential expansion of India's trade with the respective country and vice versa (Batra, 2006).

*Speed of Convergence***:** There is an uncertainty in calculating trade potential based on the above point estimates. Thus, speed of convergence has also been applied to avoid such uncertainty as this method exploits the dynamic structure of data during estimation, which offers more reliability than the analysis of point estimates (Kaur and Nanda, 2011). Speed of convergence is defined as the average growth rate of potential trade divided by average growth rate of actual trade between the years of observations.

$$\textbf{S}\text{peed of convergence} = \frac{\text{AverageGrowthRateofPotentialTrade}}{\text{AverageGrowthRateofActualTrade}} \text{X}100 - 100$$

If the growth rate of potential is lower than that of actual trade, then there is a convergence, and the computed speed of convergence is negative. There is divergence in opposite case. The negative speed of convergence reflects large scope for trade expansion while positive speed of convergence reflects that India has overused its trade potential with a particular BIMSTEC country. However, negative speed of convergence cannot reflect the convergence of actual trade flows toward potential trade. Hence, the study estimated the following simple regression model to estimate the convergence of India's actual trade flows towards the estimated equilibrium:

$$\Delta T_{ij,\,t} = \alpha + \beta\,(T_{ij,\,t-1} - Pot_{ij,\,t-1})$$

Here,

$\Delta T_{ij,t}$ = Change in actual trade value in time period t

$(T_{ij,\,t-1} - Pot_{ij,\,t-1})$ = Difference between actual and potential trade in the previous period (t-1).

Certainly, for convergence, β should be negative and significant.

Gravity Model Analysis of India's Trade with BIMSTEC Countries

TABLE 3: Descriptive Statistics and Correlation Matrix

	Mean	Std. Dev.	China Trade	Pop	GDP	GDPPC India	GDPPC BIMSTEC	GDPPC Diff	TOP India	TOP BIMSTEC	TOT	Exchange Rate	FDI *Inflow*
Trade	7.202	1.401											
China Trade	6.878	2.933	1.000										
Population	10.231	1.729	0.887	1.000									
GDP	24.543	1.952	0.967	0.853	1.000								
GDPPC India	7.044	0.337	0.353	0.091	0.423	1.000							
GDPPC BIMSTEC	7.269	0.840	0.281	-0.112	0.399	0.396	1.000						
Linder	8.039	0.918	-0.424	-0.137	-0.459	-0.224	-0.696	1.000					
TOP India	3.139	0.517	0.329	0.079	0.354	0.804	0.337	-0.148	1.000				
TOP BIMSTEC	3.721	0.528	0.086	-0.309	0.107	0.426	0.713	-0.607	0.421	1.000			
TOT	5.337	1.382	0.101	0.239	0.250	0.155	0.027	0.228	0.077	-0.382	1.000		
Exchange Rate	0.992	0.165	0.007	-0.155	0.122	0.063	0.578	-0.674	0.014	0.564	0.042	1.000	
FDI Inflow	9.627	1.076	0.337	0.086	0.390	0.903	0.368	-0.183	0.912	0.423	0.098	0.031	1.000

Source: Author's calculations, Based on the Results of Gravity Model, STATA output

This sub-section summarises the determinants which influence India's trade relations with BIMSTEC countries. Table 3 reveals the descriptive statistics relating to dependent and independent variables. India's trade with BIMSTEC countries is dependent variable while others are independent variables. The mean value of India's Trade with BIMSTEC countries is 7.202 along with standard deviation of 1.401. The mean values of independent variables namely, China's trade with BIMCTEC countries, product of population of India and BIMSTEC countries, product of GDP of India and BIMSTEC countries, GDPPC India, GDPPC BIMSTEC, Linder Effect, TOP India, TOP BIMSTEC, TOT, Exchange Rate and FDI Inflow are 6.878, 10.231, 24.543, 7.044, 7.269, 8.039, 3.139, 3.721, 5.337, 0.992 and9.627 respectively along with standard deviation of 2.933, 1.729, 1.952, 0.337, 0.840, 0.918, 0.517, 0.528, 1.382, 0.165 and1.076 respectively. Table 3 reports the correlation matrix between any pairs of two variables. The correlation between all two pairs of independent variables is less than 0.75 in case of all independent variables except product of population of India and BIMSTEC countries with China's trade with BIMCTEC countries, product of GDP of India and BIMSTEC countries with China's trade with BIMCTEC countries and product

of GDP of India and BIMSTEC countries with product of population of India and BIMSTEC countries(Gujarati, Porter & Gunasekar,2017),which indicates that multicollinearity is not serious problem in the analysis.

Table 4 highlights the estimated results of Fixed Effects Model and Random Effects Model regarding impact of independent variables on the India's trade relations with BIMSTEC countries. In order to discriminate between two models, the null hypothesis, H_o: Random Effects Model is more appropriate than Fixed Effects Model; it is tested applying the Hausman specification test.

TABLE 4: Estimated Results of Fixed Effects Model and Random Effects Model

	Fixed Effects Model			***Random Effects Model***		
Variables	***Coefficient***	***t***	***P>t***	***Coefficient***	***z***	***P>z***
China Trade	-0.178	-3.110	0.002	0.073	0.930	0.352
Population	-4.050	-0.500	0.615	7.621	0.640	0.520
GDP	7.366	0.940	0.351	-7.276	-0.610	0.539
GDPPC India	-6.575	-0.850	0.397	8.128	0.690	0.491
GDPPC BIMSTEC	-7.448	-0.940	0.348	7.401	0.630	0.532
DGPPC Differential	0.034	0.560	0.574	-0.224	-3.020	0.003
TOP India	0.771	6.850	0.000	0.727	4.590	0.000
TOP BIMSTEC	0.029	0.210	0.835	-0.079	-0.520	0.606
TOT	0.078	2.160	0.033	0.237	6.030	0.000
Exchange Rate	2.222	3.290	0.001	0.166	0.430	0.669
FDI Inflow	0.005	0.090	0.930	0.092	0.920	0.358
_cons	-35.946	-6.610	0.000	-6.243	-2.810	0.005
R^2	0.5484			R^2	93.90	
F	246.80			Wald Chi2	1938.69	
Prob>F	0.000			Prob>Chi2	0.000	

Source: Author's calculations, Based on the Results of Gravity Model, STATA output.

Table 5 reports the estimated statistics of Hausman Test. The chi-square value is 89.31 with the corresponding *p—value* 0.000, stating that the null hypothesis is rejected. The rejection of null hypothesis leads to select the Fixed Effects estimates as Random Effects estimates are inconsistent for the present study. Therefore, the analysis confirms that Fixed Effects Model is more appropriate than Random Effects Model.

TABLE 5: Hausman Test

	---- Coefficients ----			
	(b) *Fixed Effect*	*(B)* *Random Effect*	*(b-B)* *Difference*	*Sqrt (diag (V_b V_B))* *S.E.*
China Trade	-0.17811	0.072567	-0.25068	.
Population	-4.05049	7.620792	-11.6713	.
GDP	7.36623	-7.27605	14.64228	.
GDPPC India	-6.57453	8.128474	-14.703	.
GDPPC BIMSTEC	-7.44776	7.401342	-14.8491	.

DGPPC Differential	0.034007	-0.22406	0.258063	.
TOP India	0.770812	0.72727	0.043542	.
TOP BIMSTEC	0.029196	-0.07874	0.107937	.
TOT	0.077584	0.23709	-0.15951	.
Exchange Rate	2.221711	0.166486	2.055225	0.552654
FDI Inflow	0.005343	0.091564	-0.08622	.
Test: Ho: difference in coefficients not systematic chi2(8) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 89.31 Prob>chi2 = 0.000				

Source: Author's calculations, Based on the Results of Gravity Model, STATA output.

Table 4 shows that p-value of F is 0.000 which is less than alpha value 0.05, level of significance, thus the null hypothesis, H_0 stating that there is no significant impact of independent variables on India's trade with BIMSTEC countries is rejected at 5 per cent level of significance. The results suggested that independent variables have a significant role in determining India's trade with BIMSTEC countries. The coefficient of R^2 is 0.5484 which reveals that 54.84 per cent variation in India's trade with BIMSTEC countries is explained by all independent variables and for remaining 45.16 per cent discrepancy there may be some other variables which are not included in the model.

The coefficient on China's trade with BIMSTEC countries carries the negative and significant sign ($\beta_9 = -0.178; Pvalue = 0.002 < 0.05$). The variable China's trade with BIMSTEC countries reveals that with the 1 per cent increase in China's trade with BIMSTEC countries, India's trade with BIMSTEC countries will tend to decrease by 0.178 per cent, keeping other independent variables constant, at the decreasing rate.

The product of population of India and BIMSTEC countries is used as a proxy of the market size which states that large population creates more opportunities for trade. The estimated coefficient of product of population is negative and insignificant ($\beta_2 = -4.050; Pvalue = 0.615 > 0.05$). The analysis of the study indicates that with 1 per cent increase in the market size of BIMSTEC countries, India's bilateral trade will decrease by 4.050 per cent due to absorption effect at an increasing rate; however, the insignificant statistics do not support the proposition. The results of present study are in the line with previous studies conducted by Batra, 2006; Kimura & Lee, 2006; Binh, Duong & Cuong, 2011; Kaur & Nanda, 2011; Kumar &Ahmed, 2015; Alam & Ahmed, 2018; Khayat, 2019 and many others.

The product of GDP of India and BIMSTEC countries is used as proxy of economic size. The coefficient on product of GDP is positive and insignificant ($\beta_3 = 7.366; Pvalue = 0.351 > 0.05$) which states that 1 per cent increase in the product of GDP will tend to increase India's bilateral trade by 7.366 per cent at an increasing rate, but insignificant results do not support the hypothesis. The variable GDP per capita has been studied to investigate the purchasing power and stage of development of a country. In this regard Bergstrand (1985) suggested that if GDP per capita of home country is positive, then the composition of trade flow involves capital intensive products and for negative sign, the composition of trade flows involves labour intensive products. While for destination country, positive coefficient indicates that the composition of trade flow consists of luxury goods and for negative sign the composition of trade flow consists of necessity goods. The coefficient on GDP Per Capita for India bears negative and insignificant ($\beta_3 = -6.575; Pvalue = 0.397 > 0.05$) shows that the composition of trade flows consists of labour-intensive goods between India and BIMSTEC countries. On the other hand, the negative and insignificant ($\beta_3 = -7.448; Pvalue = 0.348 > 0.05$) coefficient of GDP Per Capita of BIMSTEC countries reports that the composition of trade flows consists of necessity goods between India and BIMSTEC countries.

Further, relative factor endowment or GDPPC BIMSTEC countries has been included in the model to address the question whether trade flows are large among similar countries or dissimilar countries. The positive value of coefficient shows similar countries trade less than dissimilar ones and support H-O hypothesis. On the other hand, Linder hypothesis will be supported if there is negative value of coefficient

which explains that similar countries trade more than dissimilar ones. The estimated result of the variable is negative and insignificant ($\beta_5 = -7.448; Pvalue = 0.348 > 0.05$) suggesting that Linder theory dominated in India's trade with BIMSTEC countries. Thus, trade would decrease as difference between per capita GDP of India and BIMSTEC countries would increase but insignificant results do not support the hypothesis.

The variable trade openness is the proxy of economic integration and trade liberalisation policies. The coefficient of India's trade openness is positive and significant ($\beta_8 = 0.771; Pvalue = 0.000 < 0.05$) indicating positive and significant influence on India's trade with BIMSTEC countries. Analysis of India's trade openness suggests that with 1 per cent increase India's trade openness the bilateral trade with BIMSTEC countries will increase by 0.771 per cent, with decreasing rate. The coefficient on BIMSTEC countries' trade openness bears the positive and insignificant sign ($\beta_9 = 0.029; Pvalue = 0.835 > 0.05$) impact, which show that 1 percent increase in BIMSTEC countries' trade openness will tend to enhance India's trade by 0.029 percent; however, at the decreasing rate.

The coefficient on terms of trade is found to be positive and significant ($\beta_9 = 0.078; Pvalue = 0.033 < 0.05$). The coefficient of TOT indicates that 1 per cent increase in terms of trade will tend to increase bilateral trade flows by 0.0.078 percent holding other independent variables constant. Value of coefficient TOT is less than one, suggesting that trade will increase at decreasing rate.

Exchange rate plays a vital role in the determination of bilateral trade flows between the nations. The inclusion of exchange rate in gravity model facilitated to explain the trade variation among participating countries due exchange rate fluctuations. Exchange Rate is taken as India's currency units per one unit of partner country's currency. The coefficient of bilateral exchange rate is expected to be positive for bilateral trade flow. This suggests that an increase in exchange rate or a depreciation of the rupee against trading partner currency leads to an increase in bilateral trade flows between countries (Binh, Duong & Cuong, 2011; Chaudhary,Xiumin & Khan, 2018). The analysis confirms that coefficient on exchange rate is positive and significant ($\beta_{10} = 2.222; Pvalue = 0.001 < 0.05$). This shows that with 1 per cent increase in India's currency unit with BIMSTEC countries, India's trade will increase by 2.222 per cent, with the increasing rate.

FDI variable incorporated in the model to study the impact of FDI inflow on India's trade and analysed the business integration in the backdrop of trade and investment. The estimated coefficient is positive and insignificant ($\beta_5 = 0.005; Pvalue = 0.930 > 0.05$) and indicating that an increase of 1 per cent in FDI inflows to India will increase its trade with BIMSTEC countries by 0.005 percent which is less than proportionately but insignificant results do not support the hypothesis.

As the result of Hausman specification test reveals that Fixed Effects Model is better, therefore Fixed Effect Model's country specific effects are ranked and reported in the Table-6. The positive value of country effects indicates the high propensity to trade while the negative value indicates the low propensity to trade. The values of country effects in case of all BIMSTEC countries are negative which appear to reflect the low propensity to trade with India. However, among the BIMSTEC countries Bhutan has highest propensity to trade with India while Bangladesh has lowest propensity to trade.

TABLE 6: Country Specific Effects (Estimated Fixed Effects)

Country	***Fixed Effect***	***DISTANCE***	***Language***	***Diaspora***	***Trading Affinity***
Bangladesh	-41.1961(6)	5.50	1	0	0
Bhutan	-27.2542 (1)	6.33	0	1	0
Myanmar	-38.0619(4)	6.77	0	0	0
Nepal	-36.2856(3)	6.48	0	1	0
Sri-Lanka	-34.6376(2)	7.58	1	0	0
Thailand	-38.242 (5)	7.39	0	0	1

Source: Author's calculations, Based on the Results of Gravity Model, STATA output.

Table 7, reports the estimates obtained when the Fixed Effects from model are regressed on the distance variable and dummies such as Language, Diaspora and Trading Affinity which are static over time and

unable to process together with time variant independent variables. The coefficient on Distance (2.8193) carries the positive sign, which is contrary to the expected sign, however, the insignificant *p-value* (0.646) do not support the hypothesis. The coefficient on Language (0.787) and Diaspora (7.329) depicts the positive correlation with India's trade with BIMSTEC countries but the insignificant *p-values* do not support the proposition. The variable on Trading Affinity bears (-1.918) the negative sign indicating the negative impact of Trading Affinity on India's trade with BIMSTEC countries but the insignificant *p-value* (0.878)

TABLE 7: Cross Section Regression Results of the Distance and Dummy Variables
(Dependent variable is Country Specific Effect)

	Coefficients	t	Sig.
(Constant)	-57.1447	-1.816	0.320
Distance	2.8193	0.621	0.646
Language	0.787	0.095	0.940
Diaspora	7.329	0.874	0.543
Trading Affinity	-1.918	-0.194	0.878

AsD.W = 2.141, R^2= 0.608

Source: Author's calculations, Based on the Results of Gravity Model, STATA output.

India's Trade Potential with BIMSTEC Countries

The Gravity Model is not only supportive to identifying the determinants of bilateral trade flows between India and BIMSTEC countries, but it can also be applied to predict the future trade flows or trade potential. The present study computed the trade potentials by using the Fixed Effects Model as Fixed Effects Model has been proved better than Random Effects Model. The trade potential can be computed with two methods such as difference method - difference between potential trade (P) and actual trade (A) i.e., value of P-A; and ratio method - ratio of trade potential (P) as predicted by Gravity Model and actual trade (A) i.e., value of P/A. In the present study the ratio method has been used to predict the trade potential and the estimated statistics are illustrated in the Table-8. In case the value of P/A exceeds one, it means there is potential of trade expansion with respective BIMSTEC country while the value less than one indicates that there no trade potential (Kaur, 2012). The study confirms that the average of ratio was highest for Bangladesh (195.26) followed by Thailand (9.98), Myanmar (8.51) and Nepal (1.43), Sri-Lanka (0.28) Bhutan (0.00) during 1997-2019.

TABLE 8: Trade Potential (P/A)

Year	*Bangladesh*	*Bhutan*	*Myanmar*	*Nepal*	*Sri-Lanka*	*Thailand*
1997	108.62	0.00	7.19	1.63	0.34	11.64
1998	111.39	0.00	7.91	1.65	0.38	11.26
1999	160.44	0.00	10.08	1.35	0.40	11.47
2000	157.32	0.00	10.56	1.34	0.33	10.77
2001	157.71	0.00	6.07	1.09	0.34	9.25
2002	172.38	0.00	6.70	1.33	0.29	10.62
2003	150.89	0.00	6.80	1.23	0.22	9.72
2004	185.80	0.00	8.33	1.31	0.21	9.79
2005	211.50	0.00	8.97	1.54	0.18	9.16
2006	234.98	0.00	7.63	1.87	0.20	8.65
2007	194.78	0.00	8.24	1.50	0.20	8.19
2008	218.14	0.00	8.97	1.73	0.27	8.91
2009	290.15	0.00	6.32	1.93	0.39	9.84

2010	248.87	0.00	8.11	1.79	0.27	8.65
2011	244.68	0.00	8.58	1.65	0.23	8.81
2012	213.16	0.00	8.36	1.39	0.29	9.35
2013	216.23	0.00	7.76	1.30	0.30	10.45
2014	202.94	0.00	6.35	1.04	0.22	10.79
2015	207.33	0.00	7.94	1.48	0.21	10.04
2016	209.55	0.00	6.92	1.19	0.28	10.64
2017	208.15	0.00	10.50	1.24	0.29	10.24
2018	187.89	0.00	13.15	1.13	0.25	10.32
2019	198.05	0.00	14.21	1.09	0.28	10.88
Average	195.26	0.00	8.51	1.43	0.28	9.98

Source: Author's calculations, Based on the Results of Gravity Model, STATA output.

Jakob, Kovacs & Oszlay (2000) has proposed the concept of speed of convergence to replace the old method to compute the trade potential. There is a convergence if growth rate of potential trade is lower than actual trade and the computed speed of convergence is negative. There is divergence in opposite case. Table-9 reports the output of speed of convergence in percentage, which can be classified in two groups, one characterised by overtraded group with positive sign and second with negative sign reflecting the trade potential. India has convergence in trade with Bhutan, Nepal, Sri-Lanka and Thailand and divergence with Bangladesh and Myanmar. The outcomes of speed of convergence show that India has trade potential with Bhutan, Nepal, Sri Lanka, and Thailand i.e., trade potential is not fully utilised. The speed of convergence was maximum for Myanmar (24.74) and Bangladesh (14.56) indicating that Myanmar and Bangladesh are over traded by India. Therefore, to increase the demand for Indian product in BIMSTEC countries India should take the advantage of difference in trade structures and should diversify its export basket.

TABLE 9: Speed of Convergence (Percentage)

Countries	*Average Growth Rate of Potential Trade*	*Average Growth Rate of Actual Trade*	*Speed of Convergence*
Bangladesh	14.95	13.05	14.56
Bhutan	17.53	20.64	-15.06
Myanmar	12.48	10.00	24.74
Nepal	15.49	18.23	-15.03
Sri-Lanka	10.96	14.62	-25.04
Thailand	14.83	15.45	-4.01

Source: Author's calculations, Based on the Results of Gravity Model, STATA output.

Table 10 explains whether the estimated trade flows represent an empirical equilibrium or not, in other words, whether there is convergence of actual data towards the estimated equilibrium. For the convergence, the estimated coefficient should be negative and significant (Kaur &Nanda, 2011). The results of this model stated that coefficient of independent variable was (- 0.222) and significant (*p-value* 0.079) at 10 per cent level of significance. Hence, the study reveals that there was presence of convergence in India's trade with BIMSTEC countries, means India's estimated trade flows with BIMSTEC countries is in equilibrium.

TABLE 10: The Convergence of India's Actual Trade towards Potential Trade

Model	Coefficients	t	Sig.
(Constant)	159.153	3.335	0.001
Difference between Actual and Potential Trade	-0.222	-1.768	0.079

D. W=2.056, R2 = 0.023

Source: Author's calculations, Based on the Results of Gravity Model, STATA output.

Conclusion and Policy Implications

The objectives of this paper are to evaluate India's trade performance with BIMSTEC countries, identify determinants which influence India's trade with BIMSTEC countries using Gravity Model theory and identify which of the two theories of trade i.e., Heckscher-Ohlin and Staffan Linder is applicable in case of Indo-BIMSTEC bilateral trade flows. With this aim, the study preferred the fixed effect model over random effect model based on Hausman Specification test estimates. The responsibility for the success of BIMSTEC lies on the shoulder of India, as India's GDP is highest i.e., 73.44 per cent of total GDP of BIMSTEC countries in 2019, followed by Thailand (13.89 percent), Bangladesh (7.73 per cent), Sri Lanka (2.15 per cent), Myanmar (1.94 per cent), Nepal (0.78 per cent) and Bhutan (0.07 per cent). The study reports that India's trade with Thailand is maximum followed by Bangladesh, Nepal, Sri-Lanka, Myanmar and Bhutan. India's exports are highest to Bangladesh and minimum to Bhutan, while India's imports are maximum form Thailand and minimum form Bhutan. Though the economy size of other BIMSTEC countries is small, these countries are significant for India from diplomatic, strategic and political perspectives. India's trade and exports to and imports from BIMSTEC have registered an increase in 2019 compared to 1991, but this growth is not sufficient. Since BIMSTEC is the gateway to ASEAN countries, strong economic engagement with BIMSTEC will galvanise India's business relations with ASEAN countries.

The findings of the Gravity Model based on fixed effect model confirm that trade openness of India, terms of trade and Exchange Rate have a positive and significant impact on India's trade with BIMSTEC countries. The product of GDP, GDP Per Capita Differential, Trade Openness of BIMSTEC and FDI inflow in India have positive and insignificant impact, while product of Population has negative impact on India's trade with BIMSTEC countries. The findings of GDP per capita of India and BIMSTEC countries have been described in the light of J.H. Bergstrand's hypothesis. The negative coefficient of GDP Per Capita for India shows that the composition of trade flows consists of labour-intensive goods between India and BIMSTEC countries. On the other hand, the negative coefficient of GDP Per Capita of BIMSTEC countries reports that the composition of trade flows consists of necessity goods between India and BIMSTEC countries. The study also analysed the China's trade with other BIMSTEC countries, suggesting that China's trade with BIMSTEC countries has negative impact on India's trade with other BIMSTEC countries. China's increasing trade with BIMSTEC countries can pose economic, political, diplomatic and strategic threats to India. Therefore, India should take corrective steps to enhance business engagement with BIMSTEC countries.

The variable per capita GDP differential is used to report the findings in the milieu of Eli Heckscher – Bertil Ohlin (1933) and Staffan Linder (1961) theories. H-O theory argues that countries with different level of economic development based on comparative advantages will trade more compared to country with same level. Whereas Linder theory emphasised that bilateral trade would occur between two countries having same level of economic development based on product differentiation. The coefficient GDPPC Differential bears the positive sign indicating dominance of H-O theory over Linder's theory in explaining India's trade with BIMSTEC countries suggesting countries with different economic structure will trade more. However, the insignificant *p-value* does not support the hypothesis.

The research work is based on secondary data over the period from 1997 to 2019, preferring the fixed effects model over the random effect model on the basis of Hausman Specification test, by considering fifteen independent variables. The study in the area international financial management specifically understanding India's Business relations with BIMSTEC countries has vast scope for future study. The empirical study can be pursued from the theoretical perspectives of Eli Heckscher – Bertil Ohlin theory, Staffan Linder's theory and J.H Bergstrand theory to get better understanding of Indo-BIMSTEC

economic and strategic relations. The findings of the study will help the policy makers in the formulation of trade policies and foreign policy with immediate neighbouring countries as strong economic relation between India and BIMSTEC would be helpful to make Asia stable, prosperous, and strong common market.

Authors' Contribution

Dr. Raj Kumar Singh conceived the idea to pursue the study on India's trade relations with BIMSETC countries and developed the theoretical framework, objectives, scope and hypothesis. Miss Jyoti Kumari extracted the research papers on gravity model and drafted the literature review relevant to the study. Mr. Ajay Kumar collected, edited, and coded the data. Dr. Raj Kumar Singh and Ajay Kumar analysed the data through MS-Excel, SPSS, and STATA software and prepared the tables and figures. The rough draft of the research paper was written by Mr. Ajay Kumar and Jyoti Kumari. The manuscript was finally drafted by Dr. Raj Kumar Singh. This research paper is part of Ph. D. thesis of Mr. Ajay Kumar.

Conflict of Interest

The authors certify that they have no affiliation with or involvement in any organisation or entity with any financial and non-financial interest in the subject matter or material discussed in this manuscript.

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References

Alam, I., & Ahmed, S. (2018). A Panel Gravity Model Analysis of India's Export to Gulf Cooperation Council (GCC) Countries. *Journal of International Economics, 9*(1), 72-86.

Alam, M. M., Uddin, M. G., & Taufique , K. M. (2009). Import Inflows of Bangladesh: the Gravity Model Approach. *International Journal of Economics and Finance, 1*(1), 131-140.

Banik, N. (2007). The BIMSTEC FTA and its relevance. *Centre for study in International Relations and Development: Discussion Paper# 36*.

Batra, A. (2006). India's Global Trade Potential: The Gravity Model Approach. *Global Economic Review: Perspectives on East Asian Economies and Industries, 35*(3), 327-361.

Bergstrand, J. H. (1985). The Gravity Equation in International Trade: Some Microeconomic Foundations and Empirical Evidence. *The Review of Economics and Statistics, 67*(3), 474-481.

Binh, D. T., Duong, N. V., & Cuong, H. M. (2011). Applying Gravity Model to Analyze Trade Activities of Vietnam. *In Forum for Research in Empirical International Trade Working Paper*, 1-24.

Chaudhary, S. K., Xiumin, L., & Khan, M. K. (2018). The Factors Affecting Nepal's Trade: Gravity Model Analysis. *European Academic Research, 5*(12), 6766-6782.

Dhami, J. K., Wani, N. U., & Sidana, N. (2020). Trade Potential of India Against BRCS Economies: An Empirical Analysis Based on Gravity Model. *Kardan Journal of Economics, 3*(2), 13-26.

Egger, P. (2002). An Econometric View on Estimation of Gravity Models and The Calculation of Trade Potentials. *World Economy, 25*(2), 297-312.

Egger, P., & Pfa¤ermayr, M. (2003). The proper panel econometric specification of the gravity equation: A three-way model with bilateral interaction e¤ects. *Empirical Economics, 28*(3), 571–580.

Filippini, C., & Molini, V. (2003). The determinants of East Asian trade flows: a gravity equation approach. *Journal of Asian Economics, 14*(5), 695-711.

Gujarati, D. N., Porter, D. C., & Gunasekar, S. (2017). *Basic Econometrics*. New Delhi: McGraw Hill Education.

Husain, S., & Yasmin, S. (2015). Does the Gravity Model Explain Bangladesh's Direction of Trade? A Panel Data Approach. *IOSR Journal of Economics and Finance (IOSR-JEF), 6*(3), 1-14.

Iqbal, M. H., & Islam, A. F. (2014). Determinants of Bilateral Trade Between Bangladesh and The European Union: Approach of Gravity Model Under The Panel Data. *Issues in Business Management and Economics, 2*(5), 87-93.

Jakab, Z. M., Kovacs, M. A., & Oszlay, A. (2001). How far has Trade Integration has Advanced?: An Analysis of the Actual and Potential Trade of three Central and Eastern European Countries. *Journal of Camparative Economics, 29*(2), 276-292.

Kabir, M., & Salim, R. (2010). Can Gravity Model Explain BIMSTEC's Trade? *Journal of Economic Integration, 25*(1), 143-165.

Kaur, S. (2012). *Indo-SAARC Trade: Emerging Trends and Potential*. New Delhi: Deep & Deep.

Kaur, S., & Nanda, P. (2011). An Analysis of Actual and Potential Exports of Pakistan with Saarc Countries: A Panel Data Analysis. *Pakistan Journal of Applied Economics, 21*(1), 69-91.

Khayat, S. H. (2019). A gravity model analysis for trade between the GCC and developed countries. *Cogent Economics & Finance, 7*(1), 1-13.

Kimura, F., & Lee, H. H. (2006). The Gravity Equation in International Trade in Services. *Review of World Economics, 142*(1), 92-121.

Kumar, S., & Ahmed, S. (2015). Gravity Model by Panel Data Approach: An Empirical Application with Implications for South Asian Countries. *Foreign Trade Review, 50*(4), 233-249.

Lai, A. A., & Bujang, I. (2016). The Heckscher-Ohlin Versus Linder's Theory: Evidence from Malaysian Exports. *Journal of Business and Retail Management Research, 10*(2), 1-9.

Linder, S. B. (1961). *An Essay on Trade and Transformation*. John Wiley & Sons.

Mohan, N. C. (2016). BIMSTEC: An Idea Whose Time Has Come? *Observer Research Foundation (ORF)*(164), 1-8.

Nobinkhor, K. (2015). Bilateral Trade Balance of Bangladesh with BRICS Countries: A Static Panel Data Analysis. *Journal of Economics and Development, 17*(2), 53-68.

Nguyen, H. Q. (2014). Determinants of Vietnam’s exports: Application of the Gravity Model. *MPRA Paper No. 59363*, 1-20.

Oh, J., & Prasai, L. P. (2012). Does gravity matter? Evidence from Nepal’s Trade Pattern. *International Area Studies Review, 15*(2), 161-175.

Pradhan, S. R. (2006). India’s Export Potential to the Gulf Cooperation Council (GCC) Countries: A Gravity Model Analysis. *Asia-Pacific Research and Training Network on Trade*, 1-33.

Pöyhönen, P. (1963). A Tentative Model for the Volume of Trade between Countries. *Weltwirtschaftliches Archiv*, 93-100.

Rahman, M. M. (2003). A Panel Data Analysis of Bangladesh's Trade: The Gravity Model Approach . *In Proceedings of the 5th Annual Conference of the European Trade Study Group (ETSG2003). European Trade Study Group*, 1-54.

Rahman, M. M., & Dutta, D. (2012). The Gravity Model Analysis of Bangladesh's Trade: A Panel Data Approach. *Journal of Asia-Pacific Business, 13*(3), 263-286.

Roy, M., & Rayhan, M. I. (2012). Import Flows of Bangladesh: Gravity Model Approach under Panel Data Methodology. *Dhaka University Journal of Science, 60*(2), 153-157.

Sharma, A., & Rathore, C. K. (2015). BIMSTEC and BCIM Initiatives and Their Importance for India. *Cuts International*, 1-20.

Tinbergen, J. (1962). *Shaping the World Economy; Suggestions for an International Economic Policy*. Twentieth Century Fund.

Zarzoso, I. M., & Lehmann, F. N. (2003). Augmented Gravity Model: An Empirical Application to Mercosur-European Union Trade Flows. *Journal of Applied Economics, 6*(2), 291-306.