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Ritesh Kumar Mishra
Lecturer Economics
Kashishwar Inter College
Mohanlalganj, Lucknow,
Uttar Pradesh, India

Corresponding Author:
Ritesh Kumar Mishra
Lecturer Economics
Kashishwar Inter College
Mohanlalganj, Lucknow,
Uttar Pradesh, India

Determinants of India's trade flow with South Asian countries

Ritesh Kumar Mishra

Abstract
This paper attempts to examine the determinants of export and import flows of South Asian Countries through estimations for a country panel data of eight nations during the period 1996-97 to 2021-22 using Gravity Model. The estimated result shows that GDP and Population can explain trade flow. RTA and Common Language have positive impact on trade flow. Study also found that distance might be impeding trade.

Keywords: Gravity model, panel data, regional integration, South Asian countries

Introduction
South Asia has gained great importance in the world along with the Indian subcontinent due to its geopolitical importance, strategic location, gigantic market, and prosperous democracy. As soon as the two countries in this region, India and Pakistan, became nuclear states, the region suddenly became the centre of global geopolitics. In this region, conflicts are widespread in various aspects such as border disputes, water sharing disputes, insurgencies, ethnic conflicts, and resource sharing, which makes this region very fragile, and different types of instabilities are observed in this area. In addition, differences in the region's political system often put the region under the prism of geopolitics. However, due to the availability of natural resources and huge market potential, it is well known that the region can grow and prosper when nations cooperate and co-exist amicably. South Asia as defined by SAARC is a distinctive sub-region of the Asian continent incorporating India, Pakistan, Bangladesh, Bhutan, Nepal, Afghanistan, Maldives, and Sri Lanka.
Regional trade is the strongest base through which regional cooperation in all spheres could be realised. It is a broadly accepted notion that to reap the benefits of regional integration all countries should mutually reciprocate with each other. All regional countries should understand the importance of each other cooperation to proliferate their mutual welfare. Regional Trade Agreement (RTAs) is a very important tool for accelerating growth. RTAs consolidate trade in such a way that it helps in increasing domestic productive capacity, promoting living standards, institutional reform, the invention of new technology, and easy access to desirable markets. These are the benefits that could benefit less developed economies
In this article, we examined the relevant determinants of trade i.e., export and import flow of India with South Asian Countries through estimations using Panel data of India and South Asian Countries during the period 1996-97 to 2021-22. For the estimation, we use the gravity model.
Empirical testing of the impact of various determinants on the trade flows among the nations would give us a way to identify the fundamental factors that affect the trade flow.
The panel gravity model data were collected from 1996-97 to 2021-22 (26 years). For the estimation of the Panel gravity equation, we use the data of bilateral exports and imports between India and SACs. With counting seven country pairs i.e., India- Afghanistan, India-Bangladesh, India-Bhutan, India-Maldives, India-Nepal, India-Pakistan, India-Sri Lanka.
As suggested by the literature, several variables play a significant role in the determination of Trade between two nations such as the GDP of the nations, distance between them, their population size, common ethnicity, common currency, tariff, common language, common religion, RTAs, etc.
(Bacchetta *et al*., 2012) [19,] describes a salient feature of the gravity model as unlike supply-side models such as the Ricardian and Heckscher-Ohlin models, the gravity model of trade

incorporates both supply and demand factors (GDP and population) and trade resistance (geographic factors).

Gravity Model

The origin of the gravity Model traces Newton's work and is thoroughly used by economists. The trade volume between two nations depends proportionally on the product of their GDPs and it is inversely related to the distance between them (Nobel Laureate Jan Tinbergen, 1962)

The gravity equation derived can be expressed

$$F=_G\frac{m_1 m_2}{r^2} \Longrightarrow \text{Trade}_{ij} = \alpha\frac{GDP_i GDP_j}{Distance_{ij}}$$

This equation is transformed into the linear form so that it does the usual regression analysis: log (Trade_{ij}) = $\alpha+\boldsymbol{\beta_1}$log $(GDP_i GDP_j)$-$\boldsymbol{\beta_2}$log $Distance_{ij}$+$\boldsymbol{\mu_{ij}}$

This model only uses cross-sectional data to estimate trade effects and trade relationships for a particular period.

As suggested by Matyas (1997) [20] the cross-sectional approach is affected by misspecification and suggested an approach for the gravity model that should be specified as a three-way model with the importer, exporter, and time effects.

The problem of choice of model arises between fixed effect and random effect, but in this case, the fixed effect model suffers from the major disadvantage of not being able to evaluate time-invariant effects, as suggested by (Ozdeser & Ertac, 2010) [21] if we want to estimate the impact of time-invariant and time-variant variables in the trade potential across various nations, then REM is preferable to the FEM.

In our analysis, we take dummy variables for RTA and Common Language and distance (which doesn't change for a given cross-sectional unit during the entire time series) which are time-invariant variable as it is unique to some entity within the panel and should be correlated with other characteristics. There is a high possibility that error terms can be correlated with the above-mentioned variables and thus gives us a proper reason to not chose the FEM.

We have applied the Breusch-Pagan Lagrange Multiplier Test to determine which model is appropriate either the Ordinary Least Square regression or Random Effect Model.

The null hypothesis of the test can be stated as follows:

The hypotheses of the test are:

H^0: ε2= 0, (i.e., random effects are insignificant)

H^A: ε2 0, (i.e., random effects are significant)

The test statistic is:

$$LM = \frac{IT}{2(T-1)}.\left[\frac{\sum_{i=1}^{I}(\sum_{t=1}^{T}\hat{\mu}_{it})^2}{\sum_{i=1}^{I}\sum_{t=1}^{T}\hat{\mu}_{it}^2} - 1\right]$$

Where

T is number of time periods and 1 is number of cross-sectional units

This LM statistic follows a chi-square distribution with 6 df. because we are testing for six determinants (variance of random effects term).

If the p-value is less than 0.05 then we reject the null hypothesis and accept the alternative one. i.e., the random effect model is appropriate with a 5 percent level of significance

The gravity model uses in the study is as follows

Basic Model

- $\ln EXP_{ijt} = \boldsymbol{\beta_0} + \beta_1 \ln GDP\_O_{it} + \beta_2 \ln GDP\_D_{jt} + \beta_3 \ln DIST_{it} + \mathcal{E}_{ijt}$ (1)
- $\ln IMP_{ijt} = \boldsymbol{\beta_0} + \beta_1 \ln GDP\_O_{it} + \beta_2 \ln GDP\_D_{jt} + \beta_3 \ln DIST_{it} + \mathcal{E}_{ijt}$ (2)

Where *i*, *j*, and *t* stand for exporting country, importing country, and time (year), respectively.

Augmented model

- $\ln EXP_{ijt} = \boldsymbol{\beta_0}+\boldsymbol{\alpha_{ij}} + \boldsymbol{\theta_t} + \beta_1 \ln GDP\_O_{it} + \beta_2 \ln GDP\_D_{jt} + \beta_3 \ln POP\_O_{it} + \beta_4 \ln POP\_D_{jt} + \beta_5 \ln LANG\_C_{ij} + \beta_6 RTA_{ij} + \beta_7 \ln DIST_{it} + \mathcal{E}_{ijt}$ (1)
- $\ln IMP_{ijt} = \boldsymbol{\beta_0} + \boldsymbol{\alpha_{ij}} + \boldsymbol{\theta_t} + \beta_1 \ln GDP\_O_{it} + \beta_2 \ln GDP\_D_{jt} + \beta_3 \ln POP\_O_{it} + \beta_4 \ln POP\_D_{jt} + \beta_5 \ln LANG\_C_{ij} + \beta_6 RTA_{ij} + \beta_7 \ln DIST_{it} + \mathcal{E}_{ijt}$ (1)

Where, *i*, *j*, and *t* stand for exporting country, importing country, and time (year), respectively.

EXPijt denotes exports from i to j. IMPijt denotes exports from i to j. GDP_O_{it} and GDP_D_{jt} are the GDP of countries i and j in year t. POP_O_{it} and POP_D_{jt} are the Population of countries i and j in year t. $LANG\_C_{ij}$ is a binary variable that is unity when both countries share a common language zero otherwise.

RTA_{ij} is a binary variable that is unity when both countries share a common RTA zero otherwise. $DIST_{ij}$ is the distance between the Capital of country i and j. $\mathcal{E}_{ijt}$ is the error term. α_{ij} is for capturing individual effects which imply the direction of trade flow effects from Country i to Country j. θ_t is for capturing time-specific effects.

Table 1: Predictions of estimated efficient (as suggested by the literature)

Determinant's	Suggested by	Expected sign (of their coefficients)
GDP of Country i	Frankel, Stein and Wei (1995) [25]	Positive
GDP of Country j	Frankel, Stein and Wei (1995) [25]	positive
Distance between both Country	Moktan (2008) [26]	negative
The population size of the Country i	Venables (1987) [27]	Either positive or negative
The population size of Country J	Venables (1987) [27]	Either positive or negative
Common Language	Baltagi (2003) [23]	positive
RTA	Salim and Kabir (2010) [24]	positive

The study is further divided into two sections

From the exporter's point of view

In this section, the basic model stated in equation one and the augmented model stated in equation three are used for the analysis. The period is from 1996-97 to 2021-22 and seven country pair is used. The total number of observations is 182 for each variable.

The analysis is done using STATA Software Package and the Breusch-Pagan Lagrange Multiplier Test for appropriate model selection is also done using the same software package.

From the importer's point of view

In this section, the basic model stated in equation two and the augmented model stated in equation four are used for the analysis. The period is from 1996-97 to 2021-22 and seven country pair is used. The total number of observations is 182 for each variable.

The analysis is done using STATA Software Package and the Breusch-Pagan Lagrange Multiplier Test for appropriate model selection is also done using the same software package.

From the Exporter's point of view

Result for Test of Model selection (BASIC)

The Breusch-Pagan Lagrange Multiplier Test is performed using STATA and the p-value is less than 0.05 hence null hypothesis i.e. The REM is not appropriate is rejected and the alternative one i.e., The REM is appropriate is accepted.

Result for Test of Model selection (AUGMENTED):

The Breusch-Pagan Lagrange Multiplier Test is performed using STATA for the Augmented model of export and the p-value is less than 0.05 hence null hypothesis i.e. The REM is not appropriate is rejected and the alternative one i.e., The REM is appropriate is accepted. The probability (Prob. > chi2) of LM is 0.000 indicating that the random effect model is appropriate in the case of both Basic and Augmented Models.

The random Generalized Least Square (GLS) technique is used to estimate the model. The results of basic gravity and the augmented model are displayed in Tables 2 and 3.

The regression result of the Basic and Augmented Model:

Table 2: Regression results of the basic model:

lnEXP	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
lnGDP_O	.895	.141	6.33	0	.618	1.172	***
lnGDP_D	.659	.121	5.45	0	.422	.896	***
lnDIST	-.325	.491	-0.66	.508	-1.287	.637	**
Constant	-31.503	3.907	-8.06	0	-39.162	-23.845	***
Mean dependent var	6.205		SD dependent var		1.866		
Overall r-squared	0.841		Number of obs		182		
Chi-square	852.617		Prob > chi2		0.000		
R-squared within	0.827		R-squared between		0.880		

*** $p<.01$, ** $p<.05$, * $p<.1$

Source: Researchers' Calculation

Table 2 displays the result of the basic gravity model, the finding of the study that all estimated coefficients of GDPs, population, and distance are significant at a 1 percent level with expected sign. It is concluded that the coefficients of GDPs display that a 1 percent increase in an exporter's GDP raises the volume of exports on an average by about 0.895 percent and a 1 percent increase in an importer's GDP raises the volume of exports on an average by about 0.659 percent.

The distance coefficient of the basic model is negative, as expected, clearly indicating that country prefers nearby destinations for export as compared with distant destinations.

As distance is the proxy of transportation cost, a one percent increase in the distance variable would decrease the trade by 0.325 percent.

Table 3: The regression result of Augmented Model:

lnEXP	Coef.	St. Err.	t-value	p-value	[95% Conf	Interval]	Sig
lnGDP_O	.754	.378	1.99	.046	.013	1.496	**
lnGDP_D	.461	.165	2.78	.005	.136	.785	***
lnDIST	-.135	.421	-0.32	.748	-.96	.689	**
lnPOP_O	2.159	2.317	0.93	.351	-2.383	6.7	**
lnPOP_D	-.067	.151	-0.44	.659	-.362	.229	*
LANG_C	1.651	.43	3.84	0	.809	2.494	***
RTA	.543	.245	2.22	.026	.063	1.022	**
Constant	-69.899	39.177	-1.78	.074	-146.685	6.887	*
Mean dependent var	6.205			SD dependent var	1.866		
Overall r-squared	0.907			Number of obs	182		
Chi-square	974.488			Prob > chi2	0.000		
R-squared within	0.836			R-squared between	0.966		

*** $p<.01$, ** $p<.05$, * $p<.1$

Source: Researchers' Calculation

Regression results of augmented model

Table 3 displays the result of the augmented gravity model; it is concluded that the coefficients of GDPs display that a 1 percent increase in an exporter's GDP raises the volume of exports on an average by about 0.754 percent and a 1 percent increase in an importer's GDP raise the volume of

exports on an average by about 0.461 percent.

The distance coefficient of the augmented model is negative, as expected, clearly indicating that country prefers a nearby destination for the export as compared with distance and destination. As distance is the proxy of transportation cost, a one percent increase in distance variable would decrease the trade by 0.135 percent.

The estimated coefficients on *GDP_O* and *GDP_D* have the positive sign, as expected, and are significant at the 1 percent and 10 percent levels in the model.

The GDP coefficient of the exporting country is found to be much higher than the GDP coefficient of the importing country. The result obtained in the study supported the argument that trade will enhance with country size less proportionately.

From the coefficient of the size of the population, it can be easily inferred that population size has a positive impact on export flow.

It provides evidence that an increase in the population of a country has a positive impact on trade flows.

The coefficient of POP_O and POP_D is positive and negative respectively. It is similar to the results obtained by Moinuddin (2013) [22]. RTA and Common Language have a positive impact on the export flow. The result for both is similar to the result obtained by Baltagi (2003) [23] and Salim and Kabir (2010) [24].

From the importer's point of view

Result for Test of Model selection (BASIC)

The Breusch-Pagan Lagrange Multiplier Test is performed using STATA and the p-value is less than 0.05 hence null hypothesis i.e. The REM is not appropriate is rejected and the alternative one i.e., The REM is appropriate is accepted.

Table 2 displays the result of the basic gravity model, the finding of the study that all estimated coefficients of GDPs, population, and distance are significant at a 1 percent level with expected sign. It is concluded that the coefficients of GDPs display that a 1 percent increase in an exporter's GDP raises the volume of exports on an average by about 0.895 percent and a 1 percent increase in an importer's GDP raises the volume of exports on an average by about 0.659 percent.

The distance coefficient of the basic model is negative, as expected, clearly indicating that country prefers nearby destinations for export as compared with distant destinations.

As distance is the proxy of transportation cost, a one percent increase in the distance variable would decrease the trade by 0.325 percent.

Result for Test of Model selection (AUGMENTED):

The Breusch-Pagan Lagrange Multiplier Test is performed using STATA for the Augmented model of export and the p-value is less than 0.05 hence null hypothesis i.e. The REM is not appropriate is rejected and the alternative one i.e., The REM is appropriate is accepted.

The probability (Prob. > chi2) of LM is 0.000 indicating that the random effect model is appropriate in the case of both Basic and Augmented Models.

Table 4: Regression results for basic model

lnIMP	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
lnGDP O	1.084	.257	4.22	0	.581	1.588	***
lnGDP_D	.311	.224	1.39	.164	-.427	.749	***
lnDIST	-1.604	1.025	-1.57	.118	-3.612	.405	***
Constant	-21.207	7.885	-2.69	.007	-36.661	-5.753	***
Mean dependent var		4.574		SD dependent var	2.080		
Overall r-squared		0.548		Number of obs	182		
Chi-square		243.760		Prob > chi2	0.000		
R-squared within		0.580		R-squared between	0.540		

*** $p<.01$, ** $p<.05$, * $p<.1$

Source: Researcher's Calculation

Table 5: Regression results for the basic model

lnIMP	Coef.	St. Err.	t-value	p-value	[95% Conf	Interval]	Sig
lnGDP_O	1.602	.635	2.52	.012	.357	2.847	**
lnGDP_D	.11	.305	-0.36	.719	.408	.789	*
lnDIST	-.276	1.975	-0.14	.889	-4.146	3.595	**
lnPOP_O	-1.394	3.894	-0.36	.72	-9.026	6.239	**
lnPOP_D	.514	.567	0.91	.364	-.597	1.625	**
LANG_C	.54	2.346	0.23	.818	-4.058	5.139	**
RTA	.618	.422	1.46	.143	-.209	1.445	**
Constant	-15.627	66.087	-0.24	.813	-145.154	113.901	**
Mean dependent var		4.574		SD dependent var	2.080		
Overall r-squared		0.547		Number of obs	182		
Chi-square		250.122		Prob > chi2	0.000		
R-squared within		0.591		R-squared between	0.521		

*** $p<.01$, ** $p<.05$, * $p<.1$

Source: Researcher's Calculation

The random Generalized Least Square (GLS) technique is used to estimate the model. The results of basic gravity and the augmented model are displayed in Tables 4 and 5

Table 4 displays the result of the basic gravity model, in the importer's perspective, the finding of the study is that all estimated coefficients of GDPs and distance are significant at a 1 percent level with the expected sign. It is concluded that the coefficients of GDPs display that a percent increase

in an importer's GDP raises the volume of imports on an average by about 1.084 percent and 1 cent increase in an exporter's GDP raise the volume of exports on an average by about 0.311percentt.

The distance coefficient of the basic model is negative, as expected, clearly indicating that country prefers a nearby destination for the export as compared with distance and destinations. As distance is the proxy of transportation cost t, the e percent increase in distance variable would decrease the trade by 1.604 percent.

Table 5 displays the result of the Augmented Gravity model from the importer's perspective. The estimated coefficients reflect the same result as suggested by the various Literature.

The regression result shows that the GDPs are positively related, distance is negatively related, coefficient of the population displays both positive and negative signs. The coefficient of GDP_O is 1.602 and GDP_D is 0.11.The coefficient of POP_O and POP_D is (-)1.394 and 0.514 respectively which is the same as predicted. The coefficient of the LANG_C is 0.54 which contains a variable containing one when a common language is present, zero otherwise. RTA is also a dummy variable that captures the value one when there is an RTA between the nations otherwise Table.

Conclusions

Tables 2, 3, 4, and 5 display the result of the basic and the augmented gravity model from both Exporter's perspective and the Importer's perspectives.

- The positive sign of the GDPs coefficient displays its positive impact on the trade flow (imports and exports) hence, the first null hypothesis framed for the study of this objective "H_0: There is no impact of the size of GDPs on India's trade flow with South Asian Countries" is rejected at one percent level of significance and the Alternative one i.e., "H_A: There is a positive impact of the size of GDPs on India's trade flow with South Asian Countries" is accepted.
- The negative sign coefficient of the distance between nations displays a negative impact on the trade flow (imports and exports) hence, the second null hypothesis framed for the study of this objective "H_0: There is no impact of distance on India's trade flow with South Asian Countries" is rejected at five percent level of significance and the alternative one i.e., "H_A: There is a negative impact of distance on India's trade flow with South Asian Countries" is accepted.
- The coefficient of the population displays both positive and signs which indicates that there is an impact of population on the trade flow (imports and exports) hence the third null hypothesis framed for the study of this objective "H_0: There is no impact of population on India's trade flow with South Asian Countries" is rejected and the alternative one i.e., "H_A: There is an impact of population on India's trade flow with South Asian Countries" is accepted.
- The positive sign of the RTA coefficient displays its positive impact on the trade flow (imports and exports) hence, the last null hypothesis framed for the study of this objective i.e., "H_0: There is no impact of RTA on India's trade flow with South Asian Countries" is rejected and the alternative one i.e., "H_A: There is a positive impact of RTA on India's trade flow with South Asian Countries" is accepted.

The obtained result depicts that RTA has a positive impact on intra-regional trade. The size of GDP and population among various factors can explain import and export flows from the above analysis it is concluded that GDP results in an increment in trade flow. The study also concludes the impact of distance on trade flow is significant we take it as a proxy for transport hurdles in the region. Common language has also a positive impact on trade flow, it might be due to the same religion. Hence all the determinants selected for the study has an almost similar impact as suggested by the literature.

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