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Trade potential under the SAFTA between India and other SAARC countries: the augmented gravity model approach

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ABSTRACT

The study attempts to analyse India's trade potential with other SAARC member states under the SAFTA agreement by means of the augmented gravity model, at annual frequency from 1992 to 2019 in general and from 2004 to 2019 in particular. The findings of this paper prove that the intra-regional trade volumes between SAARC countries can be increased and encouraged. Moreover, the research shows that it is important to introduce structural reforms aiming to boost trade with non-member states. It would be advisable for researchers to take into account the effect locational and infrastructural advantages have on transport costs through the application of a gravity model. Previous research has also demonstrated that the augmented gravity model may prove helpful in explaining some key features of South Asian trade, which traditional gravity models fail to do.

Key words: Cooperation/integration, augmented gravity model, panel data, trade potential, SAARC, SAPTA, SAFTA.

1. Introduction

Globalization has led to many economic activities both at the national and international levels. It has also brought fundamental changes in these economic activities. Economic integration implies close cooperation among member countries and the removal of all types of barriers in intra-regional trade. The SAARC, a regional bloc of 8 countries is a good example of economic cooperation in South Asia.

SAFTA agreement under SAARC, a collective effort of 8 participating countries, aims to enhance their intra-regional trade. There was a perceptible improvement in India's trade performance under SAFTA. It is clear from the rise in trade to gross domestic product (GDP) ratio. From 23% (1991-2003) in the pre-SAFTA, this ratio increased to 48.56% period under SAFTA (2004-2019). India is the largest and more

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developed country among SAARC countries. Its exports as a proportion of SAARC exports rose from 57.90% in 1992 to 67.53% in 2004 and further to 77.93% in 2019. Therefore, it can enhance the volume of total exports to and imports from. In this regard, it would be appropriate to estimate India's trade potential under SAFTA.

2. Review of literature

Velde, Dirk William Te (2011) analyzed how regional integration was important for convergence and growth in developing nations. He used panel data and studied 100 counties over the period 1970-2004. They made use of various analytical techniques both at the micro and macro levels. Among these techniques were "Regional Integration Index, and β and σ-convergence tests". The study found that regional integration did not lead to rapid growth at the macro level. But, it had positive effects on trade and investment in developing countries. The study recommended that regional integration was essential for the growth of member countries as it led to increased trade and investment.

Gul, Najia and Yasin, Hafiz M. (2011) in order to examine the trade potential of Pakistan, made use of the technique of the gravity model of trade. The data for the period 1981-2005 were obtained from the trade statistics of the IMF and World Bank. The trade potential of the country, both worldwide and within a specific region, was estimated using the coefficients obtained in the analysis. The study found that the volume of trade between Pakistan and other SAARC countries and the Economic Cooperation Organization (ECO) was very low. This was in spite of the fact that there existed tremendous trade potential. They cited political and social tensions as the main obstacles among South Asian nations, particularly between India and Pakistan, the two major countries of the SAARC region.

Hassan, M. Kabir (2001) attempted to analyse the viability of economic cooperation arising out of the potential for free trade among the SAARC countries. Data were collected from IMF's DOTS, UNCTAD, and UN COMTRADE for the period 1991-97, and the gravity model was used. The study found that Intra-SAARC trade was low and the countries of the SAARC region traded less with other countries of the world. This study suggested that in order to achieve trade creating benefits the SAARC countries must trade more among themselves and also with the outside world.

Hiranath, S. W. (2004) evaluated the working of the SAARC regional group under SAPTA and also examined the future possibilities of SAFTA. The Panel and Cross-sectional data on bilateral trade flow, GDP, and Per Capita GDP was taken from DOTS (IMF) and the publications of the World Bank for the period 1996-2002. The Gravity Equation was estimated by using the "Generalized Least Squares (GLS) regression technique" and it was corrected for the problems of Heteroscedasticity and Autocorrelation. The study found that there was a significant trade creation effect under SAFTA. However, the study found no evidence of trade diversion effect with the other remaining countries of the world.

Batra, Amita (2006) analysed the world trade flow of 146 countries in her study. She used an "Augmented Gravity Model" equation for her analysis. The main objective of the study was to estimate trade potential for India. The data on population and GNP was taken from WDI (World Bank, CD-ROM, 2003). The study used the OLS estimation technique for the purposes of estimation of the model using cross-sectional data for the year 2000. The findings revealed that the size of India's trade potential was highest in the "Asia-Pacific Region". This was followed by "Western Europe and North America".

Rahman, Shadat, and Das (2006) investigated the effects of the "trade creation and trade diversion on Regional Trade Agreements (RTAs)", with a particular focus on SAFTA. For the purposes of their analysis, they used the gravity model. 'The panel data approach with country-pair specific fixed effect' was used in the study. In addition to that, the regression model included the year-specific fixed effect. They used the bilateral export flow as a dependent variable. The data on bilateral flows of trade and other variables were taken from DOTS, IMF database, World Development Indicator (WDI), IFS CD-ROM for the sample of 61 countries with the time period 1991-2003. All coefficients of the gravity variables were found to carry an expected sign and were also significant statistically. The study concluded that the reduction in "tariff and non-tariff barriers" and the introduction of Rules of Origin (RoO) would increase intra-regional trade in the SAARC countries.

Ekanayake, Mukhergee, and Veeramacheneni (2010) made an attempt to study the effects of trade creation and trade diversion on RTAs in Asian countries and also their effects on intra-regional trade flows. The study made use of an AGM model for the purposes of analysis. The data for the study were taken from various publications of the UN, IMF, and World Bank for the period 1980-2009. A total number of nineteen Asian nations were selected. The results of the model showed that most of the coefficients pertaining to regional dummy variables were positive. They were also found to be significant statistically. This implied that the effect of the multilateral trade agreement on trade was more than BTAs. The study suggested that the fast evolving economic and political environment provided vast possibilities for analysing the success of economic integration in the Asian region.

Akhter and Ghani Ejaz (2010) analysed the trade agreement SAFTA and examined its role in increasing the trade potential of the members of the SAARC region and bringing in trade benefits for the countries. The study for the purposes of analysis uses the gravity model to estimate bilateral trade flows and trade potential among SAARC nations. The data on "GDP and per capita GDP were taken from the publications of World Bank, UNCTAD and WTO" for the time period 2003-2008. The findings of the study showed that the potential for trade creation existed provided there was a regional trade agreement among India, Pakistan, and Sri Lanka. However, as far as the potential for trade creation is concerned, it would be little if the SAARC members signed FTAs with other non-member countries. The basis of these findings was the data pertaining to SAPTA. The study found that SAFTA was more useful in the long run than in the short run. The trade diversion effects under SAFTA would be minimized if trade industrialization, as well as trade liberalization, continued in the region.

Therefore, the study suggested a conducive economic and social setup and also a strong political will for "economic integration and trade liberalization in the region".

Rizwanulhassan & Shafiqurrehman (2015) attempted to evaluate the extent of intra-regional trade among SAARC nations by using the "Extended Gravity Model" for the time period 1991-2010. The data on trade were taken from DOTS (IMF), on population and real GDP from WDI (World Bank), and on distance from the time and date website (timeanddate.com). The study found a significant effect of "GDP, GDP per capita, Exchange Rate Volatility, and Common Border on intra-regional trade".

Abhyaratne, Anoma, and Varma, Sumati (2017) examined the effect of the "India-Sri Lanka Free Trade Agreement (ISLFTA)" on their bilateral trade flows. The study collected panel data for the period 1990-2014 to estimate the "gravity model using the Weighted Least Squares (WLS) Method". It was found that ISLFTA had increased their bilateral trade and produced ample trade creation effects.

2.1. Objective and methodology

The objective of this study is to explore trade possibilities under SAFTA between India and other SAARC member nations by making use of the augmented gravity model. To analyze bilateral trade, the gravity approach is the most widely used empirical technique. Determination of factors affecting bilateral trade and their influence on economic growth is a highly debatable issue among the researchers. Trade potential is generally computed with the help of the gravity model in empirical research. The flow and direction of potential trade in the literature are determined by subtracting the estimated trade flows (predicted by the gravity model) and actual trade flows. Thus, the coefficients obtained from the gravity model are used to forecast trade potential for India. In the case of India, the untapped trade potential is shown by actual trade with any other member country and is less than what is predicted by the gravity model.

In the present study, the augmented gravity model is utilized to find the trade potential of India under SAFTA with other SAARC member countries from 1992 to 2019 at an annual frequency in general and from 2004 to 2019 in particular.

3. Methodological construct

3.1. The model

The gravity equation is an applied model of trade. It analyses bilateral trade among nations/states. It is similar to Newton's physics function, which describes the "force of gravity". "The model explains the flow of trade between a pair of countries as being proportional to their economic "mass" (national income) and inversely proportional to the distance between them" (Maryam and Kashim, 2015). Tinbergen (1962) and Poyhonen (1963) used the following equation:

$$T_{ij} = (GDP_i * GDP_j)/Distance_{ij} \quad (1)$$

In this equation, T_{ij} represents the trade between two participating country i and j, GDP_i and GDP_j are country i and j's national incomes respectively. $Distance_{ij}$ measures the bilateral distance between the two countries and is taken to be a constant of proportionality. Taking logarithms of the gravity equation in (1) as given above, the model becomes linear and the estimable equation becomes:

$$\text{Log } T_{ij} = \beta_0 + \beta_1 \log (GDP_i . GDP_j) + \beta_2 \log (Distance_{ij}) + U_{ij} \quad (2)$$

Where β_0, β_1, and β_2 are coefficients to be estimated. Equation (2) is the main equation where trade is found to be a positive function of income and an inverse function of distance.

The basic logic of this model is that trade has a positive relationship with the size of the trading country and a negative relation with the distance between countries. Here, the distance is taken as a proxy for information and transportation costs. As the distance increases trade decreases and vice versa. Tinbergen (1962) used the following modified equation:

$$Tij = \beta_0 \, Yi^{\beta 1} \, Yj^{\beta 2} Dij^{\beta 3} Nij^{\beta 4} \, P_c^{\beta 5} P_b^{\beta 6} \quad (3)$$

Where, Nij is the border dummy for country i and j, Y_i stands for GDP of country i while Y_j depicts the GDP of country j, D_{ij} is the distance between country i and country j, Pc shows the commonwealth preference dummy variable.

3.2. Econometric technique used in this paper

The study makes use of the augmented gravity model. According to this model, the total trade between countries depends on GDP or population, distance (a proxy of transportation costs), and other dummies that may promote or restrict the trade between them. Apart from the basic gravity variables, there are some other factors that affect bilateral trade such as cultural similarities, trade agreements, geographical location, factor endowment, and the role of development. Such factors are used to find out the trade potential of India. Real exchange is another important determinant of the trade potential. However, there were many missing values for this variable for several countries. Therefore, we are unable to include it in our model. The present study makes use of the Tinbergen (1962) following equation:

$$T_{ij} = \beta_0 \, X_{1i}^{\beta 1} \, X_{2j}^{\beta 2} \, X_{3ij}^{\beta 3} A_{ij}^{\beta 4} \, D_{ij}^{\beta 5} \quad (4)$$

Where, T_{ij} represents country i and country j's total trade, X_{1i} and X_{2j} show the GDPs of country i and country j respectively, X_{3ij} shows the distance between the two countries, Aij is the set of other explanatory control variables, D_{ij} shows the set of all

dummy variables for the two countries, and β_0 is the vector of the coefficient of all explanatory variables.

In order to make the model linear, the logarithm of the equation (4) is taken. Thus, the model in the log-linear form becomes:

$$\log T_{ijt} = \beta_0 + \beta_1 \log X_{1it} + \beta_2 \log X_{2jt} + \beta_3 \log X_{3ijt} + \beta_4 \log A_{ijt} + \beta_5 D_{ijt} + U_{ijt} \qquad (5)$$

In the above equation, the variable $\boldsymbol{A_{ijt}}$ represents explanatory variables such as per capita GDP differential (PCGDPD), and total trade to GDP (T/Y_i, T/Y_j) ratio. D_{ijt} is used for dummies like common border, language, etc.

Per Capita GDP differential (PCGDPD) is used to test the Heckscher-Ohlin (H-O) or Linder's hypothesis. The total trade to GDP ratio is taken for showing trade openness. Following the Wang and Winter (1991) study, the present study includes the border and language variables to estimate the effects of cultural factors between the countries.

The study used three gravity models for India's bilateral trade with 7 trading countries from 1992 to 2014: "(i) the gravity model of total trade (export + import), (ii) the gravity model of exports, and (iii) the gravity model of India's imports".

Thus, the gravity model for total trade becomes:

$$\log(T_{ijt}) = \beta_0 + \beta_1 \log(GDP_{it}) + \beta_2 \log(GDP_{jt}) + \beta_3 log(PCGDPD_{ijt}) + \beta_4 \log(Dis_{ijt}) + \beta_5 log(T/Y_{it}) + \beta_6 log(T/Y_{jt}) + \beta_7 (Borderij) + \beta_8 (Lan_{ij}) + Uijt \qquad (6)$$

$$\log(EXP_{ijt}) = \beta_0 + \beta_1 \log(GDP_{it}) + \beta_2 \log(GDP_{jt}) + \beta_3 log(PCGDPD_{ijt}) + \beta_4 \log(Dis_{ijt}) + \beta_5 log(T/Y_{it}) + \beta_6 log(IMP/Y_{jt}) + \beta_7 (Borderij) + \beta_8 (Lan_{ij}) + Uijt \qquad (7)$$

$$\log(IMP_{ijt}) = \beta_0 + \beta_1 \log(GDP_{it}) + \beta_2 \log(GDP_{jt}) + \beta_3 log(PCGDPD_{ijt}) + \beta_4 \log(Dis_{ijt}) + \beta_5 log(T/Y_{it}) + \beta_6 log(EXP/Y_{jt}) + \beta_7 (Borderij) + \beta_8 (Lan_{ij}) + Uijt \qquad (8)$$

Where, T_{ij} represents country i and country j's total trade, EXP_{ij} represents the total exports between two countries, IMP_{ij} is the total imports between the two countries, GDP_i is the income of country i, GDP_j shows the income of country j, $PCGDPD_{ij}$ is per capita gross domestic product differential between countries, $Dist_{ij}$ is the distance between the two countries, T/Y_i is the total trade to GDP ratio $_j$, EXP/Y_j, IMP/Y_j is the total trade/export/import to GDP ratio of country j respectively.

3.3. Panel data framework

There are several merits of using panel data methods which are not there in the case of time series and cross-sectional data. Panel data control due to individual heterogeneity and produces efficient estimates by dealing with multicollinearity in explanatory variables. The most common and widely used panel data estimation

models are the random effect model (REM) and the fixed effect model (RFM) (Gujrati, 2008). REM assumes that the intercept of each cross-section is a random variable (Gujrati, 2008). This model is more used when random intercepts are uncorrelated with explanatory variables, whereas, in the Fixed Effect Model (FEM), both individual and time effects are accounted for. In the FE model, the slope coefficients do not change. The model is useful when individual intercepts are correlated with the independent variables (Gujrati, 2008).

The present study proposes to calculate the effects of both time-invariant and time-variant variables in the factors affecting bilateral trade and India's trade potential. Therefore, Random Effect Model is preferred to the Fixed Effect Model. "REM is also preferred as numbers of cross-sections are greater than time period" (Gujrati, 2008).

3.4. Trade potentials

The calculation of trade potential is also related to the gravity model. Several studies have used various methods to find out trade potentials. The most widely used one is to use point estimates of coefficients on explanatory variables to estimate the trade potential. The study has calculated the trade potentials using the following equation:

$$\text{Trade Potential} = \text{Predicted trade flows} - \text{Actual trade flows} \tag{9}$$

Predicted values are calculated from gravity models of total trade, total exports, and total imports. The positive value means that there is a chance of increasing trade expansion and the negative value means that trade potential with selected trading countries has been already exhausted (Batra, 2004).

3.5. Results

3.5.1. Total trade determinants

The present study has used the REM to estimate the augmented gravity approach equation. The REM was selected on the basis of the Hausman Test, which resulted in p values greater than 0.05 in all the cases. We used the STATA statistical package to conduct this test. The logged dependent and independent variables mean that the estimated coefficients of the independent variables show the elasticity of variables. They show the marginal effect of the predictor variable while keeping the other variables unchanged. The present study has estimated seven models using REM so as to find the determinants of trade in India. The variables, which are considered to be significant, have been included one by one in the model. The results of the augmented gravity model are presented in Table 3.1.

Model 1 shows the standard gravity variables such as GDP and distance as used by Tinbergen (1962). The results of the study reveal that in model 1, the GDP of India and partner countries, i.e. economic size, and distance are significant with expected signs.

We include significant variables one by one to estimate the effect on other variables. We begin with lnPCGDPDij variables, and model 2 takes into account the $lnPCGDPD_{ij}$ variable while keeping all other variables used in model 1. There is a slight change in the estimated coefficients of model 2 as compared to model 1. In model 3, $Dist_{ij}$ (distance) is included and is found significant at the level of 5%. Model 4 includes lnT/Y_i and ln T/Y_j (log trade GDP ratio of country i and j respectively) and excluded $lnPCGDPD_{ij}$ and $Dist_{ij}$ (distance). LnT/Yi is significant at the level of 1%. Model 5 includes border and language dummy variables and $lnPCGDPD_{ij}$ which make $lnGDP_i$ again significant at the level of 1%. Model 6 includes $Dist_{ij}$ (distance), which makes $lnPCGDPD_{ij}$ and language dummy variables significant at the level of 1%. $Dist_{ij}$ (distance) itself is significant at the level of 1%. Model 7 is the final model that has the GDP of India and other partner countries, PCGDP differential which validates the H-O theory. This implies that countries which have a different factor of endowments generally, trade more, other variables of the model include trade openness of the two countries, distance, and dummy variables. Most of these variables turn out to be significant and show expected signs. The explanatory power of all the estimated models, as measured by R^2, has been found to be approximately the same.

The final augmented gravity model used for ascertaining the determinants of India's total trade is as follows:

$$\log(T_{ijt}) = \beta_0 + \beta_1 \log(GDP_{it}) + \beta_2 \log(GDP_{jt}) + \beta_3 log(PCGDPD_{ijt}) + \beta_4 \log(Dis_{ijt}) + \beta_5 log(T/Y_{it}) + \beta_6 log(T/Y_{jt}) + \beta_7 (Borderij) + \beta_8 (Lan_{ij}) + Uijt$$

$$\log(TSP_{ijt}) = \beta_0 + \beta_1 \log(GDP_{it}) + \beta_2 \log(GDP_{jt}) + \beta_3 log(PCGDPD_{ijt}) + \beta_4 \log(Dis_{ijt}) + \beta_5 log(T/Y_{it}) + \beta_6 log(T/Y_{jt}) + \beta_7 (Borderij) + \beta_8 (Lan_{ij}) + Uijt$$

$$\log(TSF_{ijt}) = \beta_0 + \beta_1 \log(GDP_{it}) + \beta_2 \log(GDP_{jt}) + \beta_3 log(PCGDPD_{ijt}) + \beta_4 \log(Dis_{ijt}) + \beta_5 log(T/Y_{it}) + \beta_6 log(T/Y_{jt}) + \beta_7 (Borderij) + \beta_8 (Lan_{ij}) + Uijt$$

The results of the estimated results for the gravity model of total trade are given below:

$$\log(T_{ijt}) = -28.48 + 0.286 \log(GDP_{it}) + 0.602 \log(GDP_{jt}) + 0.841 log(PCGDPD_{ijt}) - 0.871 \log(Dis_{ijt}) + 1.362 log(T/Y_{it}) - 0.217 log(T/Y_{jt}) + 0.159 (Borderij) + 1.305 (Lan_{ij})$$

$$\log(TSP_{ijt}) = -51.11 + 0.964 \log(GDP_{it}) + 0.648 \log(GDP_{jt}) + 1.246 log(PCGDPD_{ijt}) - 0.504 \log(Dis_{ijt}) + 1.015 log(T/Y_{it}) - 0.0457 log(T/Y_{jt}) + 0.262(Borderij) + 1.779 (Lan_{ij})$$

$$\log(TSF_{ijt}) = -28.60 + 0.311 \log(GDP_{it}) + 0.788 \log(GDP_{jt}) + 0.607 log(PCGDPD_{ijt}) - 1.328 \log(Dis_{ijt}) + 0.215 log(T/Y_{it}) + 0.567 log(T/Y_{jt}) + 0.388 (Borderij) + 0.782 (Lan_{ij})$$

The GDP of trading countries has an expected sign, which is a conventional and important factor of AGM. It has an expected coefficient and is statistically significant. The result provides evidence in favour of a positive relationship between the size of countries

and trade. The coefficient of per capita GDP differential is statistically significant and positive. The observed sign of the coefficient reveals that the H-O theory has a dominating impact on Linder's hypothesis. This implies that those nations usually trade more which have different factors of the endowments. Distance is also statistically significant and shows an expected negative sign. Distance has been used as a proxy for transportation costs and other time-related costs. The trade to GDP ratio shows an expected positive sign, which is significant. The trade to GDP ratio for country j shows a negative sign. The results reveal that trade openness leads to increased trade volume among them.

In order to capture the cultural effects on trade flows, the study took into account some dummy variables, namely Border and Language. The dummy variable Border takes the value 1 for Afghanistan, Bangladesh, Bhutan Nepal, and Pakistan as they share common borders with India. However, the results contradict the theoretical reasoning of this variable. Such results occur because due to military and political tensions a large volume of trade takes place between India and Pakistan. Another dummy variable, which has been taken into account to study the effects of culture on trade, is Language. This variable has the expected positive sign and is also found to be statistically significant. It is usually believed that countries sharing a common language have more trade.

3.5.2. Total trade potential of India

An important aspect of the gravity model is to estimate trade potentials. The study has calculated the total trade potentials of India with SAARC and bilateral total trade potential with 6 other SAARC member countries for the Pre-SAFTA period (1992-2003) and Under-SAFTA period (2004-2014).

In Table 3.1 we show the mean of total trade potentials by subtracting predicted trade value (P) from actual trade flows (A), i.e. value of P-A. A

Table 3.1. Total Trade Potential of India (Average)

Indicator Countries	Pre-SAFTA		Under-SAFTA	
	(P-A) 1992-1997	(P-A) 1998-2003	(P-A) 2004-2009	(P-A) 2010-2014
SAARC	-184.01	-370.21	1404.22	1567.26
Afghanistan				
Bangladesh	-238.32	-260.45	1210.03	1424.73
Bhutan	5.23	-1.05	-42.39	-60.09
Maldives	-6.54	-1.92	-5.09	34.56
Nepal	27.24	-126.13	-80.15	-751.60
Pakistan	20.43	62.89	-105.91	388.66
Sri Lanka	7.95	-43.56	427.72	531.01

As shown in Table 3.1, the study has estimated an average of 6 years in the Pre-SAFTA period, while the last average (2010-2014) is of 5 years under SAFTA. The average trade potential of India was highest for Nepal followed by Pakistan, Sri Lanka, and Bhutan in that order under the Pre-SAFTA period during 1992-1997. This shows that India had maximum trade potential with these countries, whereas for those countries which show negative value India exceeded its total trade potential, i.e. SAARC as a whole, Bangladesh and Maldives. For the period 1998 to 2003, under Pre-SAFTA, the average value of total trade potential exceeded for all except for Pakistan. So, during this period India had the highest total trade potential with Pakistan.

During the recent years, i.e. 2010 to 2014, under SAFTA, India had the highest trade potential with Bangladesh and Sri Lanka. This is clear from Table 3.1, which shows the highest average P-A value between these two countries. Also in this period, India exceeded its trade potential with Nepal and Bhutan.

3.6. Conclusion and summary

This study provides a more detailed analysis of trade potential using the augmented gravity model and commodity-wise trade possibilities using the Potential Trade Approach among the SAARC countries. This research work has computed trade possibilities and potential under SAFTA of India with other SAARC participating nations using the gravity model. The gravity model has been widely used in research for estimating the trade potential. In our case, the coefficients obtained from the model are then used to forecast trade potential for India. The gravity model shows that in the case of India actual trade with any country is less than predicted and there is untapped trade potential. The analysis is based on the panel data. Panel data estimation has many advantages and is preferred over cross-sectional and time-series data because it controls individual heterogeneity. Panel data technique enhances the efficiency of the regression estimates by decreasing collinearity among explanatory variables with ample degrees of freedom.

The results presented in this study obtained from the analysis of the gravity model show that the GDP of trading partners (a proxy for economic size) has a positive coefficient and it is also found to be significant statistically. This result lends support to the positive relationship between the economic size of trading nations and the trade flows. The estimated coefficient of per capita GDP differential (country i and country j) shows a positive sign and is also found to be statistically significant at a 1% level of significance. The positive sign of the estimated coefficient verifies the H-O hypothesis and Linder's hypothesis. This implies that the countries that generally trade more have different factor endowments. Distance is another important variable. This variable shows the expected negative sign and is also found to be statistically significant at a 1% level of significance. The variable is used as a proxy for transportation cost and other

time-related costs. Theoretically, a negative relationship exists between trade flows and the distance between trading partners. This implies that as the distance between the partners' increases, the trade flows decrease. Thus, there is a theoretical justification for including the distance variable in the hypothesis of the gravity model. Another variable, i.e. Trade to GDP ratio of country, which is the proxy for trade openness, shows an expected positive sign and is also statistically significant at a 1 % level of significance. And Trade to GDP ratio for country j shows a negative sign. The results support the theoretical reasoning of the variable, which states that the more the open economy of trading partners, the more will be the trade between them.

Apart from the above variables, the present study has also made use of some dummy variables in the analysis using the gravity model. The dummy variables were included to assess the impact of cultural effects on intra-regional trade flows. For example, the Border is a dummy, which takes the value 1 for countries like Afghanistan, Bangladesh, Bhutan, Nepal, and Pakistan as they share a common border with India. And the value zero when they do not share a common border with India. However, it is assumed that the countries sharing common borders generally share common traditions, customs, and consumption patterns also. Consequently, a positive association between a common border and trade flows is expected. But the results are contradictory and are not in harmony with the theoretical reasoning of this variable. For example, in the case of India and Pakistan, this may be because the low volume of trade between the two countries is due to political factors and strained relations. Another dummy variable used in the model for assessing cultural effects is Language. This variable shows the desired positive sign and is statistically significant. Generally, it is assumed that countries sharing a common language have more trade.

The findings of this study show that intra-regional trade volumes between SAARC nations can be increased and encouraged. It is important to undertake structural reforms so that the trade with non-member countries can also be boosted. The researchers should try to take into account the effect of locational and infrastructural advantages on transportation costs using gravity. Previous research has also argued that an augmented gravity model may help in explaining some key features of South Asian trade, which may not be explained by traditional gravity models.

3.7. Future area of research

The researchers should try to take into account the effect of locational and infrastructural advantages on transportation costs using gravity. Services ought to likewise be included and accentuation ought to incorporate whatever number of services as could be expected under the circumstances.

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APPENDIX

Table A.1. Panel Data Results of Gravity Trade Model (Random Effects Model)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	Lntrade	Lntrade	Lntrade	lntrade	Lntrade	lntrade	lntrade
Lngdpi	1.098***	1.051***	1.005***	0.369	1.011***	0.991***	0.286
	(0.146)	(0.152)	(0.120)	(0.240)	(0.126)	(0.0565)	(0.203)
Lngdpj	0.598***	0.635***	0.697***	0.578***	0.667***	0.649***	0.602***
	(0.146)	(0.146)	(0.116)	(0.157)	(0.118)	(0.0303)	(0.0523)
Lnpcgdpdij		0.176			0.321	0.854***	0.841***
		(0.221)			(0.228)	(0.112)	(0.107)
Lndistij			-1.172**			-0.886***	-0.871***
			(0.506)			(0.0991)	(0.0951)
Lntyi				1.348***			1.362***
				(0.327)			(0.345)
Lntyj				-0.0587			-0.217
				(0.192)			(0.201)
Border					0.566	0.286	0.159
					(1.048)	(0.196)	(0.220)
Language					0.929	1.330***	1.305***
					(1.005)	(0.149)	(0.143)
Constant	-37.85***	-37.35***	-36.98***	-21.98***	-44.02***	-45.15***	-28.48***
	(1.439)	(1.558)	(1.436)	(4.106)	(7.813)	(1.823)	(4.465)
Observations	138	138	138	138	138	138	138
Number of countrypair1	6	6	6	6	6	6	6

Note: Standard errors are in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A.2. Gravity Model of Total Trade under Pre-SAFTA

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	model1	model2	model3	model4	model5	model6	model7
Lngdpi	1.621***	1.649***	1.524***	1.311*	1.678***	1.628***	0.964
	(0.269)	(0.270)	(0.258)	(0.780)	(0.227)	(0.215)	(0.799)
Lngdpj	0.595***	0.586***	0.689***	0.539**	0.595***	0.641***	0.648***
	(0.169)	(0.170)	(0.152)	(0.211)	(0.0705)	(0.0409)	(0.110)
Lnpcgdpdij		0.392			1.274***	1.233***	1.246***
		(0.350)			(0.267)	(0.178)	(0.185)
Lndistij			-0.982			-0.512***	-0.504***
			(0.643)			(0.150)	(0.153)
Lntyi				0.569			1.015
				(1.114)			(1.159)
Lntyj				-0.165			0.0457
				(0.464)			(0.526)
Border					0.0641	0.226	0.262
					(0.586)	(0.267)	(0.584)
Language					1.585***	1.760***	1.779***
					(0.538)	(0.207)	(0.301)
Constant	-51.78***	-52.15***	-50.79***	-43.37***	-64.29***	-65.12***	-51.11***
	(5.513)	(5.509)	(5.538)	(16.54)	(7.049)	(5.821)	(17.29)
Observations	72	72	72	72	72	72	72
Number of country1	6	6	6	6	6	6	6

Note: Standard errors are in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A.3 Gravity Model of Total Trade under SAFTA

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Lngdpi	0.689***	0.640***	0.500***	0.591***	0.670***	0.468***	0.311**
	(0.158)	(0.177)	(0.106)	(0.185)	(0.255)	(0.111)	(0.121)
Lngdpj	0.494***	0.542***	0.675***	0.513***	0.513**	0.708***	0.788***
	(0.142)	(0.162)	(0.0864)	(0.158)	(0.240)	(0.0916)	(0.0241)
Lnpcgdpdij		0.168			0.131	0.307*	0.607***
		(0.205)			(0.287)	(0.172)	(0.0839)
Lndistij			-1.330***			-1.403***	-1.328***
			(0.322)			(0.322)	(0.0565)
Lntyi				0.277			0.215
				(0.306)			(0.367)
Lntyj				0.142			0.567***
				(0.162)			(0.132)
Language					0.0957	0.911	0.782***
					(2.152)	(0.714)	(0.120)
Border					0.131	0.626	0.388***
					(2.207)	(0.756)	(0.148)
Constant	-24.03***	-23.77***	-22.27***	-23.38***	-24.71	-29.05***	-28.60***
	(1.779)	(1.829)	(1.689)	(2.110)	(16.53)	(5.626)	(2.457)
Observations	77	77	77	77	77	77	77
Number of country1	7	7	7	7	7	7	7

Note: Standard errors are in parentheses
*** p<0.01, ** p<0.05, * p<0.1