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India's trade with South and Central Asia: an application of institution-based augmented gravity model

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Abstract

The present study investigates the effect of regional and bilateral trade agreements supported by institutional framework on bilateral trade between India and selected South and Central Asian countries. The augmented gravity model that corrects for zero trade, endogeneity and heterogeneity is used. The model is developed by applying OLS and PPML (Poisson pseudo-maximum likelihood) estimation technique using panel dataset of 22 countries from 1996 to 2020. Empirical results show that trade agreements have failed to enhance trade between selected countries. However, institutional framework positively contributes to trade integration among these countries. The key finding of this study is that regional trade agreements supported by institutional framework play an important role in promotion of trade among these countries. Thus, the government needs to pay attention to enhance institutional quality to reap the benefits of trade integration.

Keywords Regional integration, Gravity model, Institutional framework, Panel data, South Asia

JEL Classification F10, F13, F14

Introduction

World trade has increased significantly in the last few decades as along with unilateral trade liberalization, regionalism has also grown enormously. Regional trade agreements (RTAs) enhance trade between partner countries due to reduction in trade barriers. In 1950s, the idea of regionalism emerged from Europe. However, in late 1980s and 1990s, regionalism picked up the pace and started spreading all across the globe and played a significant role to shape the current world trade scenario [54].

Regional integration is considered as an effective strategy to stimulate intra-regional trade and economic development among countries. It can raise productivity and growth by increasing investment and trade, which creates large markets and new opportunities. Further, it supports reallocation of resources and development of regional production network, which enhances regional connectivity [31, 35]. It allows free access to regional markets, ensures reduction of tariff and non-tariff barriers, promotes intra-regional trade and foreign direct investment among member countries, and hence to economic development [2, 30, 34, 39]. These arguments have created a favorable environment for RTAs in recent years, particularly since the early 1990s. According to the World Trade Organization (WTO), around 578 RTAs have been notified worldwide as of August 2022.[1] However, RTAs have performed better in Europe than in other parts of the world. Intraregional trade as percentage of total trade

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[1] http://rtais.wto.org/UI/Charts.aspx

is highest in Europe (60%), followed by East Asia (35%), Southeast Asia (25%) and least in South Asia (5%).

Given the increasing importance of RTAs in other parts of the world, South Asian countries, which include India, Pakistan, Nepal, Bhutan, Maldives and Afghanistan, established a platform called South Asian Association for Regional Cooperation (SAARC) to enhance regional trade and prosperity. These member countries sign South Asian Free Trade Area (SAFTA) in 2004 and numerous other bilateral trade agreements to boost bilateral trade volume [2]. However, intraregional trade accounts for barely 5 percent of total trade in South Asia as compared to around 25 percent in ASEAN [37]. Trade among South Asian countries currently is just USD 23 bn, far below an estimated value of at least USD 67 bn. Several factors, such as inadequate road, marine and air transport facilities, have led to limited trade among these countries. Other constraints include protective tariffs, real and perceived non-tariff barriers, investment restrictions and a broad trust deficit throughout the region.[2]

Various studies in the available literature [20, 30] have concluded that RTAs have not fully succeeded in increasing and boasting regional trade in South Asia. The findings raise the question of what factors have made RTA in South Asia ineffective as compared to other parts of the world that have benefited from regional cooperation. In case of South Asia, recent literature indicates that a weak regulatory framework and political differences negatively affect intra-regional trade [37]. Similarly, Iqbal and Nawaz [30] are of the view that trade agreements complemented by well-developed and enforced democratic institutions prove effective and contribute to trade enhancement in a significant way.

The available literature on effectiveness of RTAs indirectly points toward the institutional arrangements to channel trade among member countries, as institutions can promote trade through multiple channels. It is important to mention that good quality institutions encourage market expansion, specialization, competitiveness and technological advancement by reducing transaction costs [24, 51]. In addition, well-defined institutions ensure accessibility of relevant information, contract enforcement and improved law and order, which lead to low transaction costs, more trade opportunities and high economic development [50]. It is important to mention here that the smooth function of institutions help in trade enhancement [16]. In contrast, corrupt institutions in partner countries decrease trade volume between them [18]. Institutions play an important role in economic growth, as economic growth enhances with improved quality of institutions [49].

The literature discussed above clearly highlights the importance of various institutional factors to promote trade cooperation. Countries with well-defined and effective institutions can reap the potential benefits of regional integration compared to countries where institutions are not organized systematically. However, the role of institutions, particularly in trade cooperation between India and selected countries, is missing in the available literature.

The present study contributes to the existing literature in many important ways. First, to the best of our knowledge, this is the first attempt to investigate regional integration of South and Central Asia and employ comprehensive data set and sophisticated econometric gravity model technique. The present study controls for exogenous variables, which influence trade between India and selected countries on the approaches popularized by ([8, 24, 41]). Second, although a growing number of studies [33, 40, 59, 66] highlight various factors, which hinder the process of regional integration in South Asia, the role of institutions has been neglected in the available literature. The present study tests the hypothesis that the quality of institutions in partner countries matters for bilateral trade. To check the influence of institutional factors on total trade, interaction term of RTA with institutional factors are included. In addition, trade creation and trade diversion aspect is also examined. Third, previous studies that employ gravity model are criticized for failing to consider various econometric issues related to trade costs. To address these issues, following [3, 8, 9], the present study accounts for year fixed, exporter fixed, importer fixed and country-pair fixed effects.

Regional integrational and institutional framework: some facts

From Table 1, it is clear that intra-regional trade is highest in Europe & Central Asia (69.55 percent exports and 66.58% imports), East Asia & Pacific (50.87 percent exports and 50.99 percent imports) and North America (30.1 percent exports and 18.45 percent imports) followed by other regions. The intra-regional trade volume is lowest in South Asia as compared to other regions of the world despite SAFTA and other bilateral agreements. Thus, it is clear that South Asia remains relatively unintegrated despite common history, culture and common border shared by the member countries. Table 1 clearly shows that bilateral trade remains low among member countries. In addition, the trade volume of selected Central Asian countries with South Asia is also meagre. The main trade partners of South Asian countries are outside

[2] https://www.worldbank.org/en/news/infographic/2016/05/24/the-potential-of-intra-regional-trade-for-south-asia

Table 1 Regional trade analysis (within region). Source: WITS World Bank (2022)

Region	Exports	Imports
East Asia and Pacific (EAP)	50.87	50.99
Europe and Central Asia (ECA)	69.55	66.58
Latin America and Caribbean (LAC)	14.26	14.34
Middle East and North Africa (MENA)	12.79	10.18
North America	30.1	18.45
Sub-Saharan Africa (SSA)	26.1	16.72
South Asia	7.38	1.29
Trade in South Asia		
India	0.77	6.98
Pakistan	10.05	3.39
Bangladesh	1.91	14.18
Trade of Central Asia with South Asia		
Kazakhstan	3.43	0.94
Kyrgyz	0.33	1.05
Uzbekistan	3.86	1.66

the region. In 2019, top three trade partners of the region were China, USA and United Arab Emirates (UAE).

Thus from the available data, it is clear that South Asian economies have failed to enhance bilateral trade cooperation over the years. In addition to tariff and non-tariff barriers, an unsatisfactory institutional setup may be a significant factor responsible for low trade volume. Table 2 shows the rank of selected South and Central Asian countries in various governance indicators. The highest rank is 100, which shows highest quality, while 0 shows the lowest quality. Selected countries rank very low in all indicators of governance, which may be one of the possible reasons for low integration of these countries as compared to the rest of world.

Literature review

Theoretical framework: intuitive gravity model

In the literature, several attempts have been made to derive relation between trade, GDP and distance from theoretical considerations. It is clear that there is positive relation between trade and GDP and negative relation between trade and distance. This relation between trade, GDP and distance can be established from a variety of assumptions regarding production structure and preferences. The gravity model is based on fundamental premises that trade between countries is directly proportional to economic size (GDP) and inversely proportional to geographical distance between them.

Tinbergen [64] and Poyhonen [55] were the first to apply gravity model on trade flow between countries. The model came to know as "workhorse" of international trade due to its successful application in analyzing the effect of various policy variables on trade cooperation between countries. From time to time, economists tried to formulate different theories to provide theoretical background to the gravity model. Some of these are explained as: Anderson [4] used the Cobb–Douglas production and cost function to provide a theoretical background to the gravity model. However, it was Anderson and van Wincoop [6], which provide a solid theoretical background to the gravity model by using demand-side factors of the economy. Another economist Bergstrand [10–12] in a series of attempts developed theoretical

Table 2 Worldwide Governance Indicators: (percentile rank 0–100). Source: https://databank.worldbank.org/source/worldwide-governance-indicators(2022)

Country	Voice and accountability	Political stability	Government effectiveness	Regulatory quality	Rules of law	Control of corruption
Bangladesh	26	16	20	16	30	16
Bhutan	53	84	65	40	71	92
India	53	16	66	47	54	46
Kazakhstan	15	39	60	57	38	39
Kyrgyz	31	31	32	37	18	12
Maldives	36	58	49	35	42	44
Nepal	42	41	15	24	34	29
Pakistan	23	5	31	24	25	22
Sri Lanka	43	45	50	44	53	45
Tajikistan	3	27	24	12	9	7
Turkmenistan	0.96	38	12	2	5	4
Uzbekistan	6	30	34	15	13	15

gravity model using constant elasticity of substitution and price within the model. More recently, monopolistic competition and increasing returns to scale have been used for this purpose. On the other hand, Deardorff [17] used H–O frictionless trade in homogenous products and complete specialization to construct the model. Similarly, Feenstra et al. [23] with homogenous goods, constructed reciprocal dumping model. From this discussion, it can be concluded that gravity model became an essential tool for analyzing trade flow and can also be applied to other issues like FDI, migration and tourist flow.

Empirical literature on gravity model

There is a plethora of trade literature, which have applied gravity model. Giving a theoretical justification for gravity model, Mishra et al. [47] found a positive relationship between GDP of India and its trade volume with outside world. Nevertheless, Sahu et al. [57] examined exports of India with the top 50 trade partners. The study concludes that GDP, distance, population and real exchange rate are the main factors that play an essential role in exports of India. Jagdambe and Kanna [32] analyzed trade-creation and diversion effect of Asia-India free trade agreement (AIFTA) on agriculture trade of member countries. They found that AIFTA has created trade opportunities not only for member countries but also for non-members. Mawusi [45] further augments the gravity model by incorporating economic policy uncertainty to study bilateral trade of 125 countries from 1996 to 2014. The study found that external economic policy uncertainty induced positive effects on imports and adverse effects on exports of the reporting country. Moreover, this uncertainty increases the cost of funding, which hampers potential investment in foreign markets. Further, Loganathan et al. [44] have examined the potential and benefits of FTA between India and the EU by applying three different indicators of regional trade interdependence. The results reveal that trade between India and EU are characterized by external bias, where participants trade more outside the proposed region. Thus the proposed FTA could potentially result in an "unnatural trade" between the participating countries and less welfare. Gulnaz and Manglani [27] examined bilateral trade flow between India and ASEAN from 1988 to 2019. The results indicate that the market size of partner countries plays a vital role in bilateral trade enhancement. Similarly, trade openness enhances trade in contrast to tariffs, which impede trade enhancement. Further, the results show that India enjoys the highest trade potential with Myanmar and Vietnam, followed by other member countries of ASEAN.

Akhter and Ghani [2] are of the view that SAFTA may not benefit member countries in the short run. However, to benefit from this agreement, member counties should be willing to improve tariff structure, ease foreign exchange control and transit facilities for landlocked countries in the long run. Similarly, Kumar and Ahmed [40] have examined the nature of trade flow in SAARC countries within a gravity framework. They observe that GDP and population are major factors determining regional trade. In addition, SAFTA has created trade opportunities that highlight the importance of deeper trade integration among member countries. In addition, Sharma and Kumar [59] concluded that intra-regional trade between SAARC countries could be increased, given the present economic conditions of the region.

Golovk and Sahin [26] analyzed the international integration process of Eurasian countries for the period 1994–2018. The results indicate that these countries are less integrated with the world than their potential. Thus to move closer to their potential level, these countries need to enhance their infrastructure, improve the quality of institutions, adopt liberal trade policies and sign FTAs with their top trade partners. In another study, Timsina et al. [63] examined the trade creation and trade diversion effects of FTAs signed by Australia on total and sectoral trade. The results disclose that the agriculture sector has received higher gains from FTAs than the non-agricultural sector. However, the total trade creation in both the agriculture and non-agricultural sector is higher than trade diversion, which shows the positive contribution of FTAs to the Australian economy.

These empirical studies are closely related to nexus between institutional quality and bilateral trade literature [1, 5, 29, 42, 52, 69]. These studies use various econometric approaches to study this relationship. Most of these studies conclude that institutional setup in partner countries effect bilateral trade. Highlighting the role of institutions, Anderson and Marcouiller [5] argue that well-defined institutions have enhanced trade in Latin American countries. In contrast, weak contract enforcement and high corruption levels reduce international trade. According to Francois and Manchin [25], good quality institutions positively affect bilateral trade, showing that trade between countries is linked with the institutional setup of a country. Similarly, Naanwaan and Diarrossouba [48] found that improvement in economic freedom index among participating countries tends to generate more intra-regional trade. Besides, De Mendonca [19] argue that institutions are important in explaining differences in trade between countries. In contrast, Iqbal and Nawaz [30] conclude that the RTAs supported by democratic institutions make regional integration successful. This highlights the role of different institutions in making regional integration process effective. The institutions help to reduce uncertainty related to bilateral trade. It is the institutions in a particular country

that help to reduce ambiguity and shape economic activities. The well-functioning institutions facilitate trade and help to reduce uncertainty related to global transactions. Bown [13] is of the view that threats by trade partners to renegotiate trade agreements leads to uncertainty, which could be detrimental to economic growth of a country. Kamal and Zaki [36] argue that it is the institutional setup in partner countries, which help to reduce uncertainty related to bilateral trade. Therefore, it is the institutions, which help to promote international trade. High quality of institutions leads to reduction in costs related to trade. Whereas, low quality of institutions impedes trade due to corruption, inadequate information, imperfect contract enforcement and higher transaction costs. Similarly, Nawaz [50] found that institutions indirectly complement regional integration and directly and indirectly effect bilateral economic cooperation between countries. Thus, the available literature clearly indicates the importance of institutional factors to enhance bilateral trade.

Methodology and data description

Data source and description

The dataset used is a balanced panel that includes 11 countries in South and Central Asia and 10 top trade partners[3] of India from 1996 to 2020. The focus of this study is to examine bilateral trade determinants of India with South and Central Asian countries; thus, the choice of countries is limited to these two regions and close trade partners of India. In those two regions, only the countries for which data are available are included in the present study, and there is no issue of missed data. These countries account for around 60 percent of total trade of India in 2019 (WITS, World Bank 2023). The dependent variable is total trade between countries measured in current USD. The data for total trade data are collected from Direction of Trade Statistics, IMF, whereas data for GDP and GDP per capita is taken from World Development Indicators (WDI), World Bank. Geographical distance, Language (Comlang) and Common border (Contig) are idiosyncratic characteristics that are taken into account for each pair of countries, as they may represent relevant barriers to bilateral trade. Distance between countries as well as information related to common border and common language is taken from CEPII data set. Excluding distance, which is a continuous variable, the remaining variables from CEPII are dummy variables. Information for Regional Trade Agreement (RTA) is obtained from the World Trade Organization. The study uses dummy variable, which is assigned a value of 1 if both countries are part of the agreement and 0 otherwise, to measure the effect of regional and bilateral trade agreements. The data for institutional quality are extracted from Worldwide Governance Indicators (WGI). The study is conducted at an annual frequency, and all data in value terms are in current U.S. dollars.

The institutional quality index is developed using the WGI dataset, which provides data for six dimensions to capture institutional quality. These dimensions include control of corruption (CC), government effectiveness (GE), political stability and absence of violence/terrorism (PA), rule of law (RL), regulatory quality (RQ) and voice and accountability (VA). Each dimension falls within the range of −2.5 and +2.5. Two types of institutional quality indexes are developed with a two-step procedure to achieve objectives of the present study. In the first step, following Raychaudhuri and Haldar [56], each indicator is normalized with a range from 0 to 1. In step two, following Nawaz [50], the following formula is used to construct the final index

$$\mathrm{INS}_s = \frac{1}{6}\Big(\mathrm{CC} + \mathrm{GE} + \mathrm{PA} + \mathrm{RQ} + \mathrm{RL} + \mathrm{VA}\Big) \times 100$$

In addition, an institutional quality index is developed using weighted average series to establish robustness of results. Following Raychaudhuri and Haldar [56], principal component method (PCA) is used to calculate weights.

Formulation of gravity model and econometric specification

In light of conceptual discussion above, institution-based augmented gravity model used to investigate role of institutions in bilateral trade cooperation between India and selected countries is as follows:

$$\log(T)_{ij} = \propto + \propto_1 \log\big(\mathrm{GDP}_I\big) + \propto_2 (\mathrm{GDP}_j) - \propto_3 \log\big(\mathrm{Dis}_{ij}\big) + \epsilon_{ij} \quad (1)$$

In Eq. (1), $\log T_{IJ}$ is a dependent variable, which is total trade in the present study. The independent variables include the economic size of reporting and the partner country (GDPR_{it} and GDPR_{jt}). DIS_{ij} is the geographical distance between them. In addition, the equation includes constant $\propto$, which captures country-independent effects like world liberalization.

In addition to distance, common language (Comlang) and common border (Contig) are used to comprehend trade costs. After adding these variables, the augmented gravity model is as follows:

[3] Bangladesh, Bhutan, Maldives, Nepal, Pakistan, Sri Lanka, Kazakhstan, Kyrgyz, Tajikistan, Turkmenistan, Uzbekistan, China, Myanmar, Russia, Iran, Singapore, Switzerland, USA, Saudi Arabia, UAE, Hong Kong.

$$\begin{aligned} T_{ijt} = {} & \propto_0 + \propto_1 \log(\mathrm{GDP}_{it}) + \propto_2 \log(\mathrm{GDP}_{jt}) \\ & + \propto_3 \log(\mathrm{PCGDP}_{it} - \mathrm{PCGDP}_{jt}) \\ & + \propto_4 \log(\mathrm{Dis}_{ij}) + \propto_5 (\mathrm{Contig}_{ij}) \\ & + \propto_6 (\mathrm{Comlang}_{ij}) + \varepsilon_{ijt} \end{aligned} \tag{2}$$

where $(\mathrm{PCGDP}_{it} - \mathrm{PCGDP}_{jt})$, measures the difference in per capita GDP of reporter and partner country to test the existence of intra-industry or inter-industry trade. Most often, researchers have used per capita GDP to explore the link between stage of economic advancement of a country and its level of trade. It is expected that as the two countries are more developed, it is likely that they may trade more with each other. The standard gravity model also predicts that countries with different per capita GDP levels trade less than countries with a similar per capita GDP.

Following existing literature [18, 30, 50], the present study incorporates institutional factors and regional integration to quantify the effect of these factors on bilateral trade. Similarly, an interactive term is used to examine the complementary between regional integration and institutions. Taking these factors into account, Eq. (2) is transformed into Eq. (3) as follows:

$$\begin{aligned} T_{ijt} = {} & \propto_0 + \propto_1 \log(\mathrm{GDP}_{it}) + \propto_2 \log(\mathrm{GDP}_{jt}) + \propto_3 \log(\mathrm{PCGDP}_{it} - \mathrm{PCGDP}_{jt}) \\ & + \propto_4 \log(\mathrm{Dis}_{ij}) + \propto_5 (\mathrm{Contig}_{ij}) + \propto_6 (\mathrm{Comlang}_{ij}) + \beta_1(\mathrm{RTA}_{ijt}) + \beta_2 \log(\mathrm{Inst}_{it}) \\ & + \beta_3 \log(\mathrm{Inst}_{jt}) + \theta_1(\mathrm{RTA}_{ijt}) * \log(\mathrm{Inst}_{it}) + \theta_2(\mathrm{RTA}_{ijt}) * \log(\mathrm{Inst}_{jt}) + \varepsilon_{ijt} \end{aligned} \tag{3}$$

Following the nascent application of the gravity model, the present study generates the linear model and introduces a panel framework in line with Baier and Bergstrand [8]. The estimation is performed using Poisson pseudo-maximum likelihood (PPML) proposed by Silva and Tenreyro [60–62], taking into account the fact that present sample includes large number of zeros, and obtaining estimators that are more efficient than their OLS counterparts. This estimator has been widely used in recent studies due to its consistent results [22]. Silva and Teneyro [60] strongly recommends use of PPML rather than OLS because the former includes difference in size of coefficients, which are smaller and more suitable. Head and Mayer [28] argue that in presence of dummies, PPML gives several advantages as compared as other estimators. One obvious challenge in gravity model estimation is that the multilateral resistance terms highlighted by Anderson and van Wincoop [6] are not directly observable. Following Olivero and Yotov [53], exporter-time and importer-time fixed effect are used to account for multilateral resistance terms. Another challenge in gravity model estimation is issue of endogeneity related to trade policy variable. Following Baier and Bergstrand [8] country-pair fixed effect are used to control for potential endogeneity concerns. In addition, year fixed effect is used to control for macroeconomic shocks. It is important to note here that set of country-pair fixed effect absorb all bilateral time invariant variables that are used in gravity regression. Taking into account all the above mentioned issues and following [3, 50, 67], Eq. (4) is estimated with year fixed effect (γ_t), exporter-time (π_{it}), importer-time (ρ_{jt}) and country-pair (μ_{ij}) fixed effects.

$$\begin{aligned} T_{ijt} = {} & \propto_0 + \propto_1 \log(\mathrm{GDP}_{it}) + \propto_2 \log(\mathrm{GDP}_{jt}) \\ & + \propto_3 \log(\mathrm{PCGDP}_{it} - \mathrm{PCGDP}_{jt}) \\ & + \propto_4 \log(\mathrm{Dis}_{ij}) \\ & + \propto_5 (\mathrm{Contig}_{ij}) + \propto_6 (\mathrm{Comlang}_{ij}) \\ & + \beta_1(\mathrm{RTA}_{ijt}) + \beta_2 \mathrm{RTA}_{it} + \beta_3 \mathrm{RTA}_{jt} + \beta_4 \log(\mathrm{Inst}_{it}) \\ & + \beta_5 \log(\mathrm{Inst}_{jt}) + \theta_1(\mathrm{RTA}_{ijt}) * \log(\mathrm{Inst}_{it}) \\ & + \theta_2(\mathrm{RTA}_{ijt}) * \log(\mathrm{Inst}_{jt}) + \gamma_t + \pi_{it} \\ & + \rho_{jt} + \mu_{ij} + \varepsilon_{ijt} \end{aligned} \tag{4}$$

where RTA_{ijt} is a dummy variable for the existence of a regional trade agreement; RTA_{it} is the dummy variable when only exporting country is part of trade agreement, RTA_{jt} is the dummy variable when only importing country is part of the agreement. A positive and statistically significant coefficient for RTA_{ijt} would indicate creation of more trade opportunities among member countries, while a negative coefficient would reveal intra-block trade diversion [15]. Similarly, RTA_{it} takes value of 1 if exporting country is part of the agreement and 0 otherwise. A negative coefficient implies that member countries prefer member countries to rest of world in exports, and positive coefficient indicate rise in exports to rest of the world. This was first introduced by Endoh [21] and is referred as "export trade diversion". In addition, RTA_{jt} takes value of 1 if only importer is part of the agreement in a particular year and zero otherwise. A positive coefficient shows growth of imports from non-members over member countries. Similarly, a negative coefficient indicates that member countries are diverting their import activities from non-member to member countries.

Table 3 Summary statistics

Variables	Mean	Standard deviation	Minimum value	Maximum value
TT	18.76	3.66	0	27.22
GDPi	25.35	2.37	19.92	30.69
GDPj	25.36	2.37	19.92	30.69
PCGDPD	8.64	1.98	−1.94	11.42
Contig	.12	.32	0	1
Comlang	.07	.26	0	1
DIS	8.14	.71	5.68	9.65
RTA	.12	.32	0	1
Instwi	.49	.18	.025	.96
Instwj	.49	.18	.025	.96
Insti	50.08	.18	1.61	96.86
Instj	50.08	.18	1.61	96.86
InstrRTA	5.61	.16	0	95.41
InstpRTA	5.64	.16	0	95.41

Inst_{it} and Inst_{jt} measure institutional quality index for reporter and partner country, respectively. The coefficient θ captures the effect of regional integration after interacting with institutions. Equation (4) shows that the marginal effect of regional integration on bilateral trade now explicitly depends on the value of institutions implying that.

$\Delta\text{Log}(T_{ijt}) = \beta_1 + \theta_1 \log(\text{Inst}_{it})$ in the case of reporter countries only,

$\Delta\text{Log}(T_{ijt}) = \beta_1 + \theta_2 \log(\text{Inst}_{jt})$ in the case of reporter countries only,

On the other hand, the effect of institutions on bilateral trade depends on the value of the regional integration dummy, which can also take two forms; $\frac{\partial \log(T_{ijt})}{\partial(\text{ins})}(\text{RTA}_{ijt} = 1) = \beta + \theta$ and $\frac{\partial \log(T_{ijt})}{\partial(\text{ins})}(\text{RTA}_{ijt} = 0) = \beta : \forall\beta$ and $\forall\theta$. The proposed Eq. (4) is used to examine the effect of regional integration after controlling for institutional quality. It is expected that $\forall\beta > 0$ implies that institutions and regional integration positively affect bilateral trade.

Results and discussion

The summary statistics of the variables are presented in Table 3, which shows some interesting results. First, the relatively low standard deviation (3.66) of bilateral trade suggests that the value is fairly near to its mean value. Second, standard deviation is lowest for institutional values. The minimum and maximum values are quite broad for GDP, GDP per capita and institutional factors. These results suggest that countries are heterogeneous in many aspects.

Table 4 Basic gravity model

Variables	OLS	OLS	PPML	PPML
LnGDPi	0.852*** (0.02)	0.953*** (0.02)	0.489*** (0.03)	0.732*** (0.03)
LnGDPj	0.899*** (0.01)	1.008*** (0.02)	0.785*** (0.03)	0.827*** (0.03)
LnPCGDPD	0.192*** (0.02)	0.296*** (0.02)	0.305*** (0.03)	0.156*** (0.03)
LnDIS	−0.905*** (0.07)	−1.326*** (0.08)	−0.272*** (0.06)	−0.563*** (0.08)
contig	1.613*** (0.08)	1.431*** (0.08)	0.993*** (0.12)	0.687*** (0.09)
Comlang	1.813*** (0.09)	1.513*** (0.10)	1.003*** (0.09)	0.719*** (0.07)
Constant	−20.719*** (0.61)	−22.391*** (0.62)	−12.876*** (1.24)	49.012*** (22.71)
Year fixed effect		Yes		Yes
Exporter fixed effect				Yes
Importer fixed effect				Yes
Observations	4195	4195	4759	4759
R-square	0.645	0.673	0.688	0.852
Adj. *R*-square	0.645	0.671		

Standard errors in parentheses

*$p<0.10$, **$p<0.05$, ***$p<0.01$

Table 4 enunciates the factors, which affect bilateral trade between India and selected countries. Estimation begins with basic gravity model, which includes GDP of partner countries, per capita GDP difference, common border and common language. Various estimators and model specifications are applied to check the robustness of results.

The results reveal that bilateral trade is positively determined by supply capacity (i.e., GDP of the reporting country) and demand capacity of partner country. The coefficient of supply capacity describes that 1 percent increase in GDP causes bilateral trade to enhance by 0.73 percent (model 4). Similarly, 1 percent increase in GDP of a partner country augments bilateral trade by 0.82 percent. The results indicate that wealthier nations export as well as import more as compared to poor nations. These results are consistent with economic theories and prior studies on gravity model.

Geographical distance, which is used as a proxy for physical distance between countries as defended by [43], Zofio et al. [70]). The results confirm that geographical distance between partner countries hinder bilateral trade. The negative coefficient of distance explains that 1 percent increase in distance reduces bilateral trade by 0.56 percent. The result of basic variables is consistent

with the gravity model hypothesis that trade is positively related to economic mass and negatively to the geographical distance between them. The results align with the findings of various studies [20, 50].

In addition to basic variables, coefficient of other explanatory variables also has the expected sign and is statistically significant (Table 4, Column 4). The "GDP per capita income difference" (PCGDPD) is used to study the comparative existence of Heckscher-Ohlin (H–O) theory with reference to Linder hypothesis. According to H–O theory, countries trade with each other based on factor endowment, which leads to comparative advantage in respective countries. The difference in factor endowment in different countries leads to more inter-industry trade. However, in present times, even countries with same factor endowment trade with each other, which leads to intra-industry trade. The PCGDPD focuses on the difference in factor endowment for a pair of countries. This theory is popular among economists due to its explanation of inter-industry trade [65]. Inter-industry trade among the countries is likely to be significant when there are differences in factor endowment. In contrast, among the countries that enjoy similar level of development and factor endowment, intra-industry trade dominates. The estimated coefficient is significant and has a positive sign, which indicates higher volume of bilateral trade between partner countries. Hence, it can be concluded that the H–O hypothesis dominates the Linder hypothesis, which means that countries with different factor endowments have a higher inter-industry flow than intra-industry trade [38]. This result suggests the domination of inter-industry trade between India and its major trading partners.

In addition to the factors discussed above, common border and common language play an important role to enhance bilateral trade between member countries. The estimated coefficient of common border has a significant and positive effect on trade enhancement between partner countries. The results indicate that common border increases trade by (exp (0.687) − 1)*100 = 98 percent compared to countries that lack a direct link. This implies that countries sharing common border trade more with each other. Similarly, positive and significant coefficient of common language indicates that countries that share common language trade more with each other than countries that speak different languages. The estimated coefficient shows that holding everything else constant, common language between countries enhances bilateral trade. The results confirm with what other studies have suggested, language acts as a tool for networks and communication, which promotes bilateral trade. Similar results are found in case of [66, 58].

To quantify the effect of trade integration, gravity model is augmented and re-estimated using PPML with exporter fixed effect, importer fixed effect, year fixed effect and country-pair fixed effect. The results are presented in columns (1–8) of Table 5. The estimated models are significant as is clear from Wald test.

The effect of basic variables, which have been discussed above remains the same. In addition to SAFTA, bilateral trade agreements signed by these South and Central Asian countries have also been included. The empirical analysis indicates that these trade agreements have been unable to create trade opportunities for member countries. Some recent studies [20, 50] also concluded that RTAs have failed to produce desired results in case of South Asia.

The next step is to estimate the effect of RTA in terms of trade creation and trade diversion. The coefficients in different models may vary due to year fixed, exporter fixed, importer fixed and country-pair fixed effect taken into account. RTA_{it} and RTA_{jt} which represent export and import trade diversion from member to nonmember countries are statistically significant and have positive sign. This indicates that RTA have diverted trade from member to nonmember countries. Thus, it can be concluded that RTA is unable to create trade opportunities for member countries in case of South Asia.

The present study extends the gravity model to examine the effect of institutional factors on regional and bilateral trade cooperation between selected countries. An institutional quality index (IQI) is used to quantify the role of institutional setup. To achieve objective of the study, two type of index are used; one with simple average of all indicators; second with a weighted average. In addition, IQI is incorporated in the model for reporting (Insti) and partner country (Instj) separately. The results show that institutions have a significant and positive effect on bilateral trade of selected countries. The coefficient of reporting country indicates that 1 percent improvement in the performance of domestic institutions increases bilateral trade by 1.27 percent. This highlights importance of institutional setup to enhance trade cooperation with rest of the world. According to Nawaz [50], improvement in domestic institutions leads increase in bilateral trade. Similarly, in partner countries, 1 percent improvement in the performance of institutions leads to 3.22 percent increase in bilateral trade. Thus from these results, it is clear that supportive institutions are necessary and can play an important role to enhance bilateral trade. These results are in line with available studies signaling that legal security, market competition and corruption are some of serious concerns in economic relations, which hamper bilateral trade and economic growth. Such is the case of Yu et al. [68] who highlighted the importance of

Table 5 Augmented gravity model results

	(PPML)	(PPML)	(PPML)	(PPML)	(PPML)	(PPML)	(PPML)
LnGDPi	0.735*** (0.31)	0.896*** (0.02)	0.895*** (0.02)	0.905*** (0.02)	0.901*** (0.02)	0.597*** (0.03)	0.596*** (0.03)
LnGDPj	0.837*** (0.02)	0.803*** (0.02)	0.814*** (0.02)	0.825*** (0.02)	0.813*** (0.02)	0.420*** (0.02)	0.419*** (0.02)
LnDIS	−0.567*** (0.07)	−0.799*** (0.05)	−0.799*** (0.05)	−0.814*** (0.05)	−0.818*** (0.05)		
LnPCGDPD	0.156*** (0.02)						
Contig	0.702*** (0.09)	0.201*** (0.07)	0.228*** (0.08)	0.234*** (0.07)	0.221*** (0.07)		
Comlang	0.731*** (0.07)	0.747*** (0.06)	0.752*** (0.06)	0.777*** (0.05)	0.772*** (0.06)		
RTAij							−0.708*** (0.08)
RTAi						0.481*** (0.05)	0.536*** (0.05)
RTAj						0.368*** (0.05)	0.415*** (0.06)
InstwiRTA		0.682*** (0.12)					
InstwjRTA			0.668*** (0.06)				
Instwj				3.229*** (0.48)			
Instwi					1.275*** (0.41)		
Wald test	=3365.41 Prob > chi2 =0.0000	=3558.81 Prob > chi2 =0.0000	=3589.95 Prob > chi2 = 0.0000	=4600.64 Prob > chi2 =0.0000	=3725.68 Prob > chi2 =0.0000	=5347.21 Prob > chi2 = 0.0000	=6518.69 Prob > chi2 = 0.0000
Constant	−15.95*** (1.26)	−15.31*** (0.72)	−15.57*** (0.72)	−16.11*** (0.68)	−15.64*** (0.72)	−22.39*** (0.54)	−22.39*** (0.54)
Exporter fixed effect	Yes	Yes	Yes	Yes	Yes		
Importer fixed effect	Yes	Yes	Yes	Yes	Yes		
Year fixed effect	Yes	Yes	Yes	Yes	Yes		
Country pair fixed effect						Yes	Yes
Observations	5085	9954	9954	9954	9954	10,498	10,498

Standard errors in parentheses

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$

institutional quality. Similarly, Anderson and Marcouiller [5] concluded that corruption acts as basic impediment to trade. Thus in line with available literature, results in the present study highlight importance of institutional quality in domestic and partner countries to promote bilateral trade cooperation.

In addition to these institutional factors, interactive terms of RTAs and institutions (RTA*Inst) are added to the model to assess complementary between regional integration and institutions. Two different interactions are added that capture the interaction of regional integration with reporting country (InstiRTA) and partner country (InstjRTA). The results presented in Table 5 (Column 7–8) show that the interaction term of reporting and partner countries have positive effect on bilateral trade cooperation. The positive sign of interactive terms shows that the reductive effect declines with improved quality of institutions. This indicates that institutions can play an important role in trade enhancement and the effectiveness of regional and bilateral trade agreements. In the available literature, similar results were reported by Nawaz [50] who concluded that RTAs supported by institutional quality enhance bilateral trade between countries. The results in present study are consistent with number of previous empirical studies on effect of institutional quality on bilateral trade cooperation between countries [14, 18, 46]. Well-defined institutions provide way to implement required reforms to benefit from

bilateral and multilateral trade agreements. A country which lacks basic infrastructural facilities may not be able to benefit from trade agreements irrespective of concessions provided through these trade agreements. A high quality of institutions leads to smooth transactions and low transaction costs associated with trade. To summarize, the empirical findings in the present study indicate that institutions play an important role in trade cooperation between countries. In addition, RTAs supported by institutional quality in partner countries leads to more enhanced trade cooperation as compared to countries, which lack basic institutional facilities.

Conclusion

The present study identifies the role of different factors to examine bilateral trade cooperation of India with selected South and Central Asian countries. The empirical analysis is performed using institutions-based augmented gravity model with panel dataset of 22 countries from 1996 to 2020, inclusive. The study controls for widely-used gravity masses, such as market size (GDP of partner countries), income per capita, geographical distance and set of binary variables that are believed to effect bilateral trade between India and partner countries.

The results align with the theoretical background of variables and have expected signs. The basic econometric specification consists of various theoretical determinants of bilateral trade flows, such as bilateral distance, GDP, existence of common language and common border. In addition, the augmented gravity model, which includes other variables besides income and distance is used. The empirical results confirm the robustness of gravity equation, for results were akin to established theories on the subject. Moreover, along with income and distance, common language and common border play an important role in the bilateral trade cooperation of these countries.

In addition to these factors, empirical analysis assesses the effect of regional and bilateral trade agreements supported by institutional framework. The results indicate that trade agreements have failed to create trade opportunities for partner countries, which indicates importance of proper trade liberalization policy in case of selected countries. Similarly, results provide strong support for the important role of institutions in bilateral trade cooperation of India and selected countries. The interactive term of trade agreements and institutional framework indicate positive contribution, which highlights the complementary association between these factors. Thus, these findings emphasize that regional or bilateral trade agreements can be more effective if supported by institutional framework. They provide evidence that the institutional framework in these countries positively contributes to enhancement of bilateral trade. These findings appear to be consistent with achievements made by India in buildings up and rejuvenating its domestic institutions to ease of doing business and encourage foreign investors to invest in the country. Over the years, despite many challenges at domestic and international level, India has gradually improved institutional setup in the country. According to the World Economic Forum (2023) report,[4] the country has improved its rank in global competitiveness index from 43 in 2019 to 40 in 2023. It is important to mention here that the country ranked at 71 in 2015, which improved to 43 in 2019.

Based on the findings in the present study, government in selected countries need to focus on critical infrastructure to reduce trade costs. In addition, as institutions are key to reap the benefits of trade agreements, these countries need to focus mainly on institutional reforms to improve institutional quality and enhance regional and bilateral trade cooperation. Institutional reforms incur short-term costs as noted by Angkinand and Chiu [7]. However, they have significant effect on sustaining long run economic performance and enhance trade cooperation between countries in addition to attract foreign investment. Improvement in performance of domestic institutions are expected to improve export competitiveness of India and enhance its exports that are believed to generate ripple effect on economics performance of the country. These findings are also relevant for other developing countries in South and Central Asia as they have a long way to go before they achieve the goal of sustainable economic development.

Scope for future research

The present study can be extended to examine effect of different individual factors, which represent institutional quality setup in a particular country. The individual factors can give a better understanding of which factors are more important given the institutional setup in a country.

Abbreviations

PPML	Poisson pseudo-maximum likelihood
RTAs	Regional trade agreements
WTO	World trade organization
SAARC	South Asian Association for Regional Cooperation
SAFTA	South Asian Free Trade Area
AIFTA	Asia-India free trade agreement
FTA	Free trade agreement
EU	European Union
PCA	Principal component method (PCA)
IQI	Institutional quality index (IQI)

Author contributions

Both the authors have contributed to this manuscript equally.

[4] https://www.imd.org/centers/wcc/world-competitiveness-center/publications/

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Additional data are available with the author and can be obtained at request.

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