

Impact of Regional Trade Integration-Case of South Asia

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Abstract

In this paper, impact of regional trade integration a case of South Asia is evaluated. Despite the large potential and availability of inputs like land, labour and capital the countries of South Asia namely India, Pakistan, Bangladesh and Sri Lanka are far behind from full use of regional trade integration. The data of four countries i.e. India, Pakistan, Bangladesh and Sri Lanka is taken as a sample for regression. After regression, this paper witnessed that volume of trade in South Asia has significantly increased after formation of SAARC but still it has a big potential to improve. The regression analysis shows that growth in GDP, Population, and Foreign Exchange contributed positively in growth of exports whereas decrease in exchange rate and CPI has also positive impact in growth of exports. The paper witnessed that formation of SAARC does not have any significant impact on trade creation or trade diversion. It is evaluated that though consistent efforts have been made at the regional level for regional integration through formation of SAFTA (i.e. South Asian Preferential Trade Agreement) under SAARC but due to mutual conflicts, hatred, lack of trust and smuggling (i.e. black marketing) role of SAARC is insignificant. In this regard, it is proposed that if better policies be chalked out i.e. tariffs rates be reduces, trading quotas are removed, trade among regional countries be promoted then the goal of high trade can easily be achieved. The availability of better infrastructure, sound institutions, skilled labour and better communication system is the key towards promotion of regional trade integration.

Introduction

Trade plays an important role in economic wellbeing of people throughout world. Trade provides an opportunity to people to make many choices for economic development and enhance their choices in different corridors of life. It is quite evident that countries with better institutions, modern communication network and robust transport infrastructure have an upper edge to grab high chunk of trade volume. Likewise, the countries with efficient and autonomous institutions, better administrative network, and good human development, less bureaucratic procedures, good supply of inputs and with skilled labour force have an opportunity to lead others in trade and business. In this era of globalization, where countries are interacting with one another more frequently, competition to grab a big volume of market for goods become a tough competition and a work of an art. In this era of competition, only those countries are successful which are well equipped with skill, human development and high technology. Due to variety of markets and different preferences, producers wanted to produce in a cheap market regardless of distance and physical barriers due to improvement in transportation networks. The improvement in road network gave birth to innovation and introduction of new products in market. The new modes of packaging, production, marketing and innovations are being introduced which have revolutionised market networks and resulted in expansion of markets. The volume of business is increased to such an extent that orders are dispatched to suppliers on the basis of their efficiency, least time for supply of orders, followed by efficient dispatch of orders. Likewise rest of world particularly developed world, South Asian countries namely India, Pakistan, Sri Lanka and Bangladesh are trying to get benefit from new trading patterns by virtue of globalization through formation of different regional organizations like SAARC and other bilateral and multilateral agreements. These four countries are main trading partners of South Asia with a population of about 1.5 billion (approximately). In this paper, it will evaluate that after formation of regional organization whether these are successful in boosting their exports or otherwise.



Regional Trade

Regional trade is a process in which different states came closer to each other. The process of integration varies from one way to other and from one region to other. The form of integration could be political, economic, or social or blend of all. The regional integration can further be explained as a group of countries which form an association of common interest with a focus to achieve a common goal namely: economic progress followed by social, economic, political and environmental interests. Such type of countries works in a similar symmetry by forming a common line of action and policy of common interests. According to Hans (2003) regional integration refers to the process by which states within a particular region increase their level of interaction with regard to economic, security, political, social and cultural issues. The countries in all parts of world formed different groups such as ASEAN, SAARC, NAFTA, EU and African league etc. with a prime objective to remove trade barriers, to enhance free flow of goods and services, to ensure free access of labor in member countries and create an environment of trade facilitation. According to Wilson et. al. (2003) who identified four different categories of trade facilitation such as availability of port facilities, Customs Environment, Regulatory mechanism and E- business facilities. He further maintains that countries with availability of above mentioned facilities are best performers in trade.

Global Map of Regional Blocks



According to Ikenson (2008) in various countries particularly developing countries of South Asia imposition of tariff quota is not a big issue rather bureaucratic and administrative hurdles hamper process of trade growth which is commonly known as Trade Facilitation Measures (TFM). The countries with better Trade Facilitation Measures (Likewise in Developed world) are in a better position to take an advantage than others. In a broad sense, the better environment of transportation, customs facilities, harmonized and state-of-the-art administrative network is a key to progress.

Regional Trade: Case of South Asia

South Asia ranks one of the most important regions of world for better trade and business opportunities. The population of south Asia is about 1.5 billion (approximately). It has well established road networks, rail roads and a better communication system. The main countries of South Asia are India, Pakistan, Sri Lanka, Bangladesh and other South Asian countries like Nepal, Bhutan and Maldives. By realizing its potential, such countries made attempts to reduce its tariffs and customs duties but due to various reasons, still cost of business is high as compare to developed countries. More importantly, problems like , transportation network is not efficient to cope with demands of orders, administrative machinery is not efficient to deliver promptly, communication network is faulty and mode of transportation through trucks is out dated. For example, trucks of member countries are not allowed to transport goods in other neighbouring countries

across the borders due to mutual conflicts and lack of trust. In addition, cost of transportation for delivery of goods in South Asian countries except Sri Lanka is very high. The condition of trucks is too old and so fragmented that cost of transportation further increased manifold. Likewise road networks, cargo rail system is not efficient which is more time consuming and expensive. In South Asia, though efforts are being taken to harmonize the custom duties, to reduce tariffs, to develop better and simple rules and regulations, improve communication system followed by free flow of goods but still a long way to go to achieve cherished goals.

Map of Regional Trade Blocks



In order to achieve trade growth, South Asian countries tried to come close to each other through different treaties and bilateral agreements such as SAARC and ECO etc. All such type of strategies are formed to remove conflict, anger, hatred and wars among neighboring countries which in turn will remove conflicts, crimes, lack of confidence, smuggling and mutual rivalry. South Asian countries now have realized their importance of regional trade and its advantages. Besides many advantages, some advantages of regional trade are: enhancement in trade volume through trade creation and trade diversion, steps towards free market economy and regional trade blocks, strengthening of public sector institutions, social inclusion of various active groups of society and exclusion of conflict created elements are mile stones which these countries wanted to achieve. However, all these goals could only be achieved when trade related conflicts should be replaced with enhanced trade and business activities.

An overview of regional trade agreements



According to World Bank, intergenerational trade is less than 5% of total trade in South Asia. South Asian preferential trade agreement (SAPTA) and South Asian free trade agreement (SAFTA) are two most important agreements. SAPTA is designed among the countries like India, Pakistan, Bangladesh, Sri Lanka, Maldives, Nepal and Bhutan. Within framework of SAARC, Indo-Sri Lanka free trade agreement (ISFTA) is chalked out for free trade between India and Sri Lanka. Similarly, Pak-Sri Lanka free trade agreement

(PSFTA) was designed between Pakistan and Sri Lanka. The main aim of these agreements is to boost exports through regional trade, make free flow of goods and reduce cost of trading.

Dynamics of Trade in South Asia

South Asia occupies an important position in trade flow among different countries due to strategic locations. South Asia is a region which is highly populated; roughly 1/5th of world population is living in this part. The major countries of this part are India, Pakistan and Bangladesh. South Asia is mainly an agricultural region which heavily depends upon agricultural goods such as Cotton, Wheat, Rice, Sugar-Cane, Jute, pulses, dates, mangoes and various types of fruits. Among all these countries India is the largest one which has more advanced infrastructure, IT services and better established institutions and skilled labour force as compare to other neighbouring countries followed by Pakistan. Though the South Asia is possessing huge resources but unfortunately despite various efforts either at bilateral level, regional level or multilevel, the success has not been made to make region free from all types of tariffs, custom duties and quotas. According to Weerahava (2009) the trade in South Asia has not been boosted due to fact that little attention has been paid towards trade liberalization, free flow of goods and services and improvement of infrastructure. According to her, she has taken into account the five main products which have been estimated for gravity model. Despite the fact that SAARC is the main regional body but till yet it did not produce desired results. Statistically speaking India is the largest country among SAARC countries with high volume of trade and growth. The GDP growth of India was 8%, followed by Pakistan with 7.5%, Sri Lanka 5.5% and Bangladesh with 5.4% respectively. The exports of India in year 2005 were 23.9% followed by Pakistan with 16.8%, Bangladesh with 12.9% and Sri Lanka with 12.19% in year 2005. The major exports of these countries are agricultural commodities but more importantly it increased due to increase in price of commodities, improvement in shipment of goods and removal of quota for textile goods in US. Among all these countries the exports of India are greater than other countries due to diversification and big trade volume and better infrastructure and administrative facilities. The volume of Indian exports includes durable goods, intermediary goods, mainly in agriculture, textiles and manufacturing followed by services and IT sector.

Percentage of Export Goods Trade According to Commodity Groups

India		Pakistan		Sri Lanka		Bangladesh	
Textiles	21.5	Textiles	68.9	Textiles	53.4	Textiles	85.8
Stone	17.2	Vegetables	7.3	Vegetables	17.3	Animals	5.6
Chemicals	10.6	Leather	5.8	Plastic	6.5	Leather	3.0
Minerals	9.1	Vehicles	3.0	Stone	4.7	Chemicals	1.4
Metal	9.0	Furniture	2.8	Mechanical	3.2	Other	4.2
Mechanical	7.0	Minerals	2.8	Metal	3.0		
Plastic	3.2	Animals	1.5	Animals	2.1		
vehicles	3.1	Foodstuff	1.5	Vehicles	2.0		
Animals	2.8	Plastic	1.3	Foodstuff	1.9		

Source: UN COMTRADE, <http://unstats.un.org/unsd/comtrade>

Literature Review

The trade in South Asian countries is taking place in commodities like textiles, leather, sea food, stones, chemicals, plastics and other agricultural commodities. The main trade among the countries is in form of textile and agriculture goods. The main market for South Asian countries is in Middle East and second

biggest market for South Asian economies is US and European Union. Among all these countries, India has the largest share of exports to US, EU followed by Pakistan, Sri Lanka and Bangladesh. According to Wilson et. al. (2003) better port and communication facilities have a great impact on economic growth of regional countries. The countries like South Asia where the port, customs, administrative and banking facilities are not adequate therefore it resulted in shipment delays which in turn increase the cost of goods. According to Djankov et.al (2006) a country bears an extra cost of 1% for each additional day delay due to shipping or communication problems. He further explains that this cost further increased if nature of good is perishable, Similarly, UN data i.e. UNCTAD (2001) a decrease in 1% of expenditures like storing and better packaging will boost the GDP of Asian countries by 3.3\$. He further maintains that an improvement in facilities such as wholesale and retail services boost the GDP to an extent of 3.59 billion \$.

Likewise Djankov, et al (2000) opines that an increase and improvement in relative number of web hosts and communication houses will result in increase in trade flows by 1%. Similarly, Flink et.al (2000) believe that if a country pays a focus on reduction of communication cost and successful in reducing it to 9.9 % will result in growth of bilateral trade by 7.75%. Likewise, road network in any country plays a vital role in growth of trade. The Asian countries though are big in population and trade volume but due to availability of small and congested roads the business is not very up to mark. The performance of corridors and shipment can be seen in table:

Corridor	Distance by Road	Distance by Rail	Expected Time to be completed	Cost of Shipment by road	Cost of Shipment by rail
Dhakka-Chittagong	219.5 Km	297.5 km	3.25 days	100.25US \$	142 US \$
Delhi - Mumbai	1407.5 Km	-	2.15 days	455 US \$	-
Lahore-Karachi	1310 Km	-	2.25 days	460 to 625 US \$	-

Source: Author's estimates, India, TCI 2002
Load limit, actual 50–100 per cent more owing to overloading

The performance in terms of cost

Country	No of wheels to truck	Load Capacity(tons)	Cost US \$ per KM
India	06	8.75	0.533
Pakistan	06	9.75	0.245
Bangladesh	06	8.5	0.525

Source: Author's estimates, India, TCI 2002
Load limit, actual 50–100 per cent more owing to overloading

Volume of Trade flows in South Asia

The south Asian countries despite their regional potential are involved towards extrovert approach rather than introvert. The South Asian countries have volume of trade with Western countries, Middle East and US rather than regional one. The large flow of trade is taking place in shape of textiles, leather, agriculture goods and sea food. The major areas of trade are US, UK, EU, Middle East countries and to some extent South Asian countries. Besides that, other trading partners are Australia, New Zealand and some Pacific countries. Among all these countries, India is the largest county in terms of area, population productivity and trade. The volume of trade (i.e. imports) of India with European countries is 15.95, with China 8.95% with Saudi Arabia 6.8%. Likewise imports, the volume of exports of India to EU is 22.9%, US 15.25% and UAE is 8.9%.As it is witnessed that trade in South Asian countries is less as compare to trade among countries of other parts and Western world and US. It is mainly because of the trade barriers, lack of trust and mutual misunderstandings and tariff barriers. The restrictions among South Asian countries is in form of tariff barriers Custom duties, whereas in form of non-tariff barriers includes technical and standard related issues which force them to look beyond South Asia rather than within same region.

Export volume of different goods (in tons)

Bangladesh Exports to ASEAN countries	Fish	Vegetables	Textiles
2001	3361	727.5	6640.8
2002	1861	790.5	7867.6
2003	3883	1648.46	9375.3
India Exports to ASEAN countries			
2001	53227.3	179080	7635.3
2002	14388.3	169498	13814.4
2003	24216.2	209736	22786.3
Pakistan Exports to ASEAN countries			
2001	6724.2	50580	693.5
2002	10318.2	44642	827.5
2003	868.2	827	929.5
Sri Lanka Exports to ASEAN countries			
2001	868.2	49.5	322.3
2002	971.1	93.5	1062.2
2003	1001.3	288.3	1186.6

Source: UN COMTRADE as reported by importing countries

Market Share of South Asian Countries in terms of (%) in last three years

Bangladesh	2001	2002	2003
ASEAN 10	2.2	2.1	2.15
EU 25	60.5	60.8	64.8
NAFTA	37.7	37.5	33.1
India			
ASEAN 10	26.3	20.2	24.1
EU 25	41.2	41.3	42.2
NAFTA	32.2	38.1	34.2
Pakistan			
ASEAN 10	20.1	17	13
EU 25	41.2	44	45
NAFTA	39.3	39	42
Sri Lanka			
ASEAN 10	1.2	1.1	1.1
EU 25	51.2	46.3	49.2
NAFTA	48.3	53.2	50.1

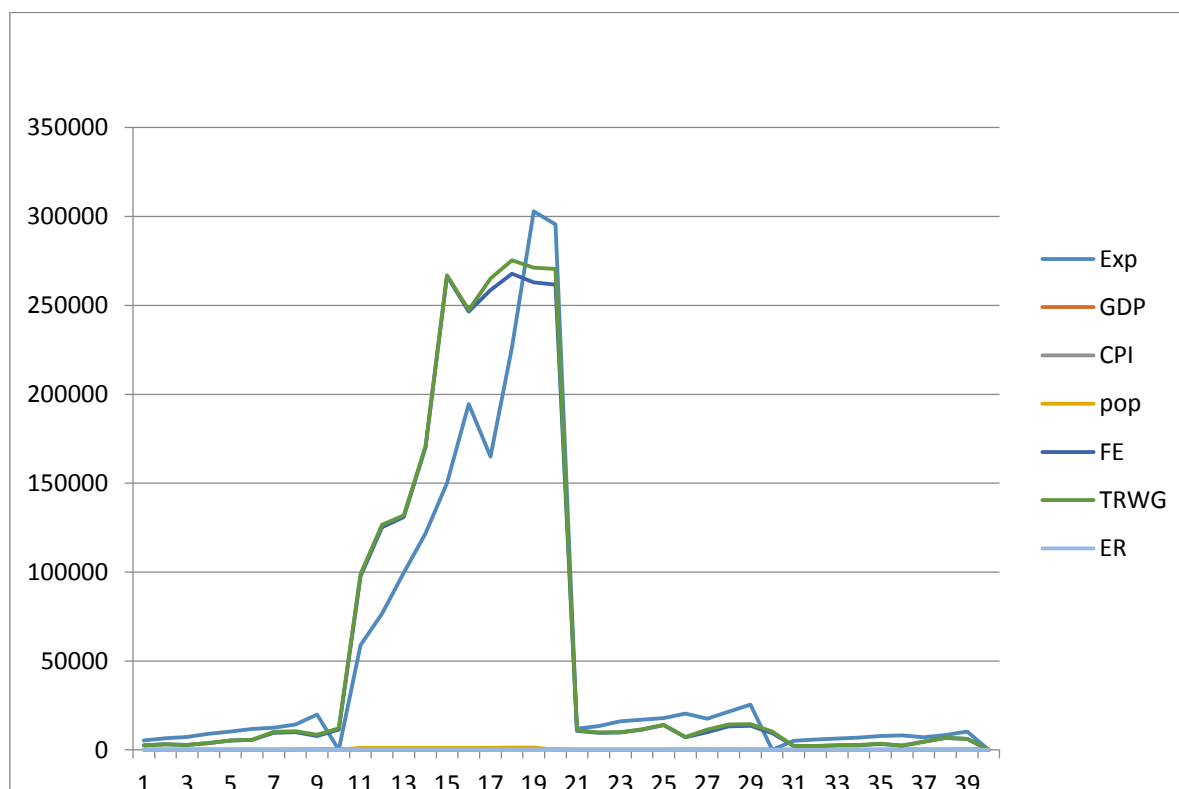
Source: UN COMTRADE as reported by importing countries

Travelling Times of Trans Shipments

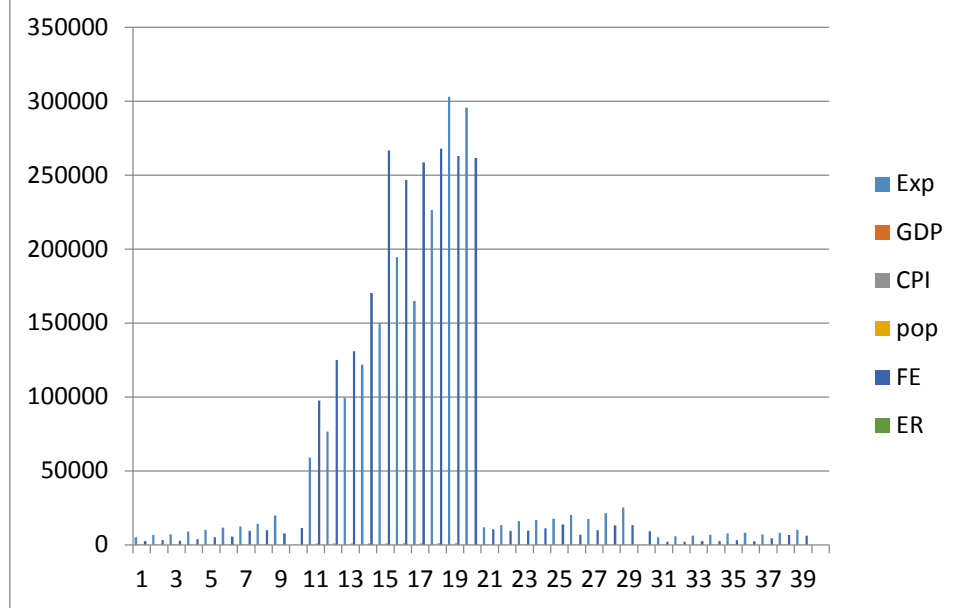
From	To	No. of Days
Kolkata/Haldia via Colombo	North Europe	14 to 21
Kolkata/Haldia via Colombo	US east coast	35 to 40
Kolkata/Haldia via Colombo	Meditarinian	25 to 30
Kolkata/Haldia via Singapore	China	18 to 20
Kolkata/Haldia via Singapore	US West Coast	29 to 35
Kolkata/Haldia via Singapore	Australia	23 to 27

Source: Selected shipping schedules

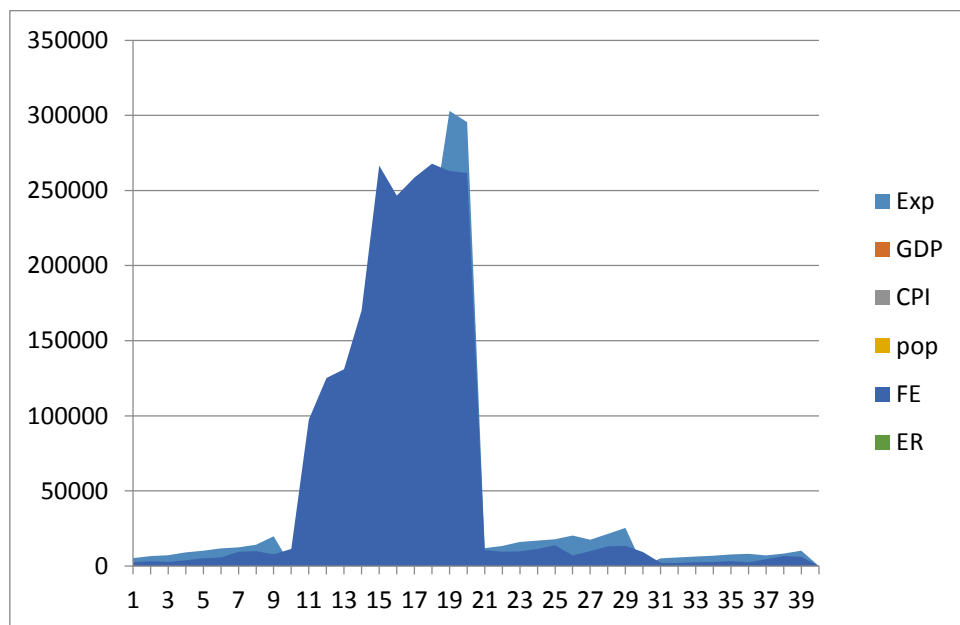
A graphical representation of Export growth due to increase in GDP,CPI, Population, Foreign Exchange, Total Reserves (without gold) and Exchange Rate.



Source: IMF Data (2003 to 2012)



Source: IMF Data (2003 to 2012)



Source: IMF Data (2003 to 2012)

Port efficiency and Customs environment

The port efficiency, logistics performance of ports and shipment is of utmost importance. This sort of proxy is developed by World Bank to measure performance of countries how effective they are to ship the goods in least possible time. The efficiency of a country is measured through the time taken for clearance of shipment and logistic support. The availability of better and safe transport network, better shipment and trading facilities, availability of information technology system with a procedure to track the record of shipment and logistics, competence in local earliest shipments followed by better competence of labour and their quality of work are benchmarks of better trade. In terms of shipment and logistics, performance of developed countries is far better than developing countries because of availability of modern technology, ability to do that, use of information technology system, skilled labour and availability of high tech equipment's. As compare to these statistics, developing countries are far behind particularly countries of South Asia. However, in terms of all these figures, performance of India is far better than other developing countries due to strong institutions and road network. Besides these factors, there are other reasons which include tariff and non-tariff barriers which are badly hampering the volume of trade in South Asian countries. The non-

tariff barriers include no of standards and custom duties imposed for regulation of trade. The other measure is restrictions on import of goods in such a way which creates blockade for a number of countries. Anti-dumping and countervailing measures are permitted by WTO with a provision to safeguard one's own industry but it should be according to standards of WTO and different agreement either at bilateral, regional or multilateral level. According to Hoekman and Nicita (2008) the difference between overall trade restrictive index and tariff trade restrictive indexes is the measure of Net trade barriers (NTB). According to statistics, India is the best performer in terms of infrastructure, logistics, communication, working capabilities, shipping facilities, the documentation processed, whereas the worst case is of Afghanistan which recorded very poor performance. The trading facilities in all South Asian countries are significant. In terms of trade facilities, Sri Lanka is ranked high, followed by Pakistan and India. Likewise, Nepal is not a good performer in any case of trade facilities. According to Jeewica (2009) improvement in LPI is recorded in India i.e. 0.72 and least cost in terms of trade is recorded in Pakistan. She further maintains that if all countries act like this then the trade cost can be reduced up to 18.25% and volume of agricultural trade can be increased up to 27.5%

Regression Analysis

In order to evaluate growth of regional countries, a Gravity model is developed with an annual panel data downloaded from IMF website from year 2003 to 2012 in order to see the potential of exports in South Asian countries. As a sample data of four countries i.e. India, Pakistan, Bangladesh and Sri Lanka is taken. For regression analysis, data of four countries is summed up and then regressed. Sum of exports of four countries (i.e. India, Pakistan Bangladesh and Sri Lanka) is taken as a dependent variable, whereas, GDP (sum of GDP of four countries), CPI (sum of four countries), Population (sum of four countries), Foreign Exchange (sum of four countries) and Exchange Rate (sum of four countries) is taken as independent variables. In regression analysis, log of all variables is taken for the sake of non-linear results.

Regression Model

$$\text{Ln (exp)} = \beta_i(\text{ln gdp}) + \beta_{ii}(\text{ln cpi}) + \beta_{iii}(\text{pop}) + \beta_{iv}(\text{ln foreign exchange}) + \beta_v(\text{ln exchange rate})$$

Variable (in log form)	Coefficient	S.E	t-ratio
GDP	1.4	0.416	3.35
CPI	-1.04	0.371	2.82
pop	0.46	0.107	4.26
Foreign Exchange	0.61	0.431	14.26
Exchange Rate	-1.76	0.486	3.62
Constant	-7.3	2.12	3.41

(Note: The regression analysis is attached as appendix 1)

After creating a regression model log (export) is regressed with log (GDP), Log (CPI), Log (Pop), Log (foreign exchange), log (total revenue without gold), log (exchange rate).The variable of SAARC is created

as a dummy variable. In the first model, p value is less than 0.005 which shows that model is significant. In first model, the values of total reserves without gold are individually insignificant, but as a whole in model provide significant results. So we assume that these two variables are individually insignificant but jointly significant. It can also be interpreted that though after creation of SAARC, though exports of these four countries were expanded but the overall impact of SAARC in regional trade is not significant. From this analysis, we can conclude that role of SAARC in regional integration is insignificant. Since the value of SAARC is insignificant, therefore, after creation of SAARC, there is neither trade creation nor trade diversion. However, similar types of results were given by other studies too. According to Bouett and et. al. the only beneficiary of SAARC is SRI Lanka, in which trade was created because of low tariffs whereas, other countries did not benefit from it.

In another model in which a variables i.e. total revenue without gold (trwg) and dummy variable i.e. SAARC are eliminated because both are insignificant.

So the model is:

$$\ln(\text{exp}) = \beta_i(\ln \text{gdp}) + \beta_{ii}(\ln \text{cpi}) + \beta_{iii}(\text{pop}) + \beta_{iv}(\ln \text{foreign exchange}) + \beta_v(\ln \text{exchange rate})$$

The final model gives the robust results and shows that after regional trade integration the GDP of four countries is increased @ 1.4%, CPI decreased @ 1.05%, population increased @ 0.5%, foreign exchange increased @ 0.6% and exchange rate decreased @ of 1.8%. The t value gives the significant results, whereas, value of p is also less than 0.005. The value of F test is less than 0.005 and value of R square is 98% which proves that the model is significant. From this analysis, we can say that in South Asia a huge potential of trade growth lies and if these countries should focus on regional integration than trade can further be enhanced. In the first model the dummy variable of SAARC is created but it did not provide significant value individually which means that though overall trade is increasing but specifically role of SAARC is insignificant in trade growth.

Stochastic Frontier Model

Variable(in log form)	Coefficient	S.E	z-ratio
GDP	1.4	0.380	3.67
CPI	-1.04	0.339	3.09
Pop	0.46	0.097	4.67
Foreign Exchange	0.61	0.039	15.62
Exchange Rate	-1.76	0.443	3.97
Constant	-7.3	1.955	3.71

Note: Regression analysis is attached as Appendix 2.

For the regression purpose, stochastic frontier model test is used to assess the inefficiencies in model. Since analysis shows that in South Asian countries a lot potential is available for growth but due to inefficiency in trade sustainable growth has not yet been achieved. After regression model proved robust and gave sound results. The p value of whole model is less than 0.005 which shows that model is significant and all variables are individually contributing in export growth of South Asia. The individual z value of all variables is significant. The regression analysis shows that GDP is positively contributing in export growth of South Asia @ 1.4%, the value of CPI and exchange rate are significant and show that with increase in exports the CPI is decreasing @ 1.04% and exchange rate @ 1.76%. Likewise, values of population and foreign exchange are positively contribution @ 0.45% and 0.61% respectively.

Fixed Effect Model

Mixed-effects ML regression		Number of obs	=	36		
Log likelihood = 15.99992		Wald chi2(5)	=	2122.64		
		Prob > chi2	=	0.0000		

nexp	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	

ngdp	1.39596	.3803499	3.67	0.000	.6504879	2.141432
ncpi	-1.049696	.3395663	-3.09	0.002	-1.715234	-.3841584
npop	.4570157	.0978308	4.67	0.000	.2652709	.6487605
nfe	.6145166	.0393473	15.62	0.000	.5373973	.691636
ner	-1.761535	.4438161	-3.97	0.000	-2.631398	-.891671
_cons	-7.258912	1.940618	-3.74	0.000	-11.06245	-3.45537

Random-effects Parameters		Estimate	Std. Err.	[95% Conf. Interval]		

sd(Residual)		.1551472	.0182843	.1231485	.1954605	

In fixed effect model all the variables are treated as all quantities are non-random. The model helps in checking heterogeneity. The basic assumption in this model that explanatory variable are correlated with dependent variable. After using the fixed effect model, the variables like trwg and sarc (i.e. total reserves without gold and dummy variable of SAARC) have been removed. The fixed effect model gives good results in which p value of all variables individually as well as collectively is significant. The individual z value of all variables is significant.

Multivariate test of Means, Covariance and Normality

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mvtest means nexp ngdp ncpi npop nfe ner
Test that all means are the same

Hotelling T2 = 121099.79
Hotelling F(5,31) = 21451.96
Prob > F = 0.0000
    
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By using another test like multivariate test of means, covariance and normality, the p value is less than 0.005 which shows that there is no variation among the variables from their mean. Secondly, the multivariate test of means rejects the null hypothesis and accepts alternative hypothesis which means that the variation among the variables from their mean is normal.

Conclusion

South Asia is a region with diverse trade a lot of opportunities. Despite various hurdles and problems trade in this region is continuously increasing. Among various issues which put hurdles in a way of smooth trade like high cost of transport lack of trust on each other are hurdles in a way of smooth growth. By considering potential of trade in intra- regional trade and different regions of world it can easily be said that a huge potential can be explored in this part of world due to availability of cheap inputs, raw material and labour. It is evident from regression that actual trade in South Asian countries is done by non-South Asian countries whereas, volume of trade within SAARC countries is just 7% of global trade due to lack of infrastructure, poor planning, lack of resources, out dated communication system , strict regulations, weak institutions and inconsistent policies among member countries. After regression analysis, it can easily be said that so many areas of trade are available in Asian trade which requires consistent efforts, reduction of trade costs and improvements in facilities, if all such type of milestones can be achieved then the volume of trade can be increased to a significant level and poverty, hunger, illiteracy and other problems of region can be eliminated at the earliest.

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Appendix (1)

. reg nexpgdp ncpi npop nfe ntrwgnersarc

Source	SS	df	MS	Number of obs =	36
Model	51.1401768	7	7.30573954	F(7, 28) =	249.53
Residual	.819770366	28	.029277513	Prob > F =	0.0000
				R-squared =	0.9842
				Adj R-squared =	0.9803
Total	51.9599472	35	1.48456992	Root MSE =	.17111

nexpgdp	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
ngdp	1.261769	.4564839	2.76	0.010	.3267039	2.196834
ncpi	-1.030628	.3751159	-2.75	0.010	-1.799018	-.2622376
npop	.5116712	.1232839	4.15	0.000	.2591355	.764207
nfe	1.990846	1.338644	1.49	0.148	-.7512423	4.732934
ntrwgnersarc	-1.382264	1.347858	-1.03	0.314	-4.143226	1.378698
ner	-2.002557	.5488978	-3.65	0.001	-3.126923	-.878191
sarc	.0537276	.102333	0.53	0.604	-.155892	.2633472
_cons	-7.960187	2.643896	-3.01	0.005	-13.37596	-2.544412

. reg nexpgdp ncpi npop nfe ner

Source	SS	df	MS	Number of obs =	36
Model	51.0934034	5	10.2186807	F(5, 30) =	353.77
Residual	.866543823	30	.028884794	Prob > F =	0.0000
				R-squared =	0.9833
				Adj R-squared =	0.9805
Total	51.9599472	35	1.48456992	Root MSE =	.16996

nexpgdp	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
ngdp	1.39596	.4166524	3.35	0.002	.5450422	2.246878
ncpi	-1.049696	.3719763	-2.82	0.008	-1.809373	-.2900192
npop	.4570157	.1071683	4.26	0.000	.238149	.6758825
nfe	.6145166	.0431028	14.26	0.000	.5264889	.7025444
ner	-1.761535	.4861762	-3.62	0.001	-2.754439	-.7686303
_cons	-7.258912	2.125841	-3.41	0.002	-11.60046	-2.917366

Appendix (2)

```

. frontier nexp ngdp ncpi npop nfe ner
Iteration 0: log likelihood = 15.973256
Iteration 1: log likelihood = 15.98313
Iteration 2: log likelihood = 15.99224
Iteration 3: log likelihood = 15.996077
Iteration 4: log likelihood = 15.997615
Iteration 5: log likelihood = 15.999214
Iteration 6: log likelihood = 15.999468
Iteration 7: log likelihood = 15.999757
Iteration 8: log likelihood = 15.999836
Iteration 9: log likelihood = 15.999875
Stoc. frontier normal/half-normal model
Number of obs = 36
Wald chi2(5) = 2122.63
Prob > chi2 = 0.0000
Log likelihood = 15.999918
    
```

nexp	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
ngdp	1.39596	.3803512	3.67	0.000	.6504855 2.141435
ncpi	-1.049696	.3395675	-3.09	0.002	-1.715236 -.3841558
npop	.4570157	.0978311	4.67	0.000	.2652702 .6487611
nfe	.6145166	.0393475	15.62	0.000	.537397 .6916362
ner	-1.761534	.4438176	-3.97	0.000	-2.631401 -.8916678
_cons	-7.256453	1.955244	-3.71	0.000	-11.08866 -3.424246
/lnsig2v	-3.726901	.2373982	-15.70	0.000	-4.192193 -3.261609
/lnsig2u	-11.5442	192.1995	-0.06	0.952	-388.2483 365.1599
sigma_v	.1551364	.0184146			.1229354 .195772
sigma_u	.0031132	.2991786			4.93e-85 1.97e+79
sigma2	.024077	.0057966			.0127158 .0354382
lambda	.0200676	.3019073			-.5716599 .611795

```

Likelihood-ratio test of sigma_u=0: chibar2(01) = 0.00 Prob>=chibar2 = 1.000
Stoc. frontier normal/half-normal model
Number of obs = 36
Wald chi2(5) = 2122.63
Prob > chi2 = 0.0000
Log likelihood = 15.999918
    
```

nexp	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
ngdp	1.39596	.3803512	3.67	0.000	.6504855 2.141435
ncpi	-1.049696	.3395675	-3.09	0.002	-1.715236 -.3841558
npop	.4570157	.0978311	4.67	0.000	.2652702 .6487611
nfe	.6145166	.0393475	15.62	0.000	.537397 .6916362
ner	-1.761534	.4438176	-3.97	0.000	-2.631401 -.8916678
_cons	-7.256453	1.955244	-3.71	0.000	-11.08866 -3.424246
/lnsig2v	-3.726901	.2373982	-15.70	0.000	-4.192193 -3.261609
/lnsig2u	-11.5442	192.1995	-0.06	0.952	-388.2483 365.1599
sigma_v	.1551364	.0184146			.1229354 .195772
sigma_u	.0031132	.2991786			4.93e-85 1.97e+79
sigma2	.024077	.0057966			.0127158 .0354382
lambda	.0200676	.3019073			-.5716599 .611795

```

Likelihood-ratio test of sigma_u=0: chibar2(01) = 0.00 Prob>=chibar2 = 1.000
Iteration 10: log likelihood = 15.999898
Iteration 11: log likelihood = 15.999908 (not concave)
Iteration 12: log likelihood = 15.999911
Iteration 13: log likelihood = 15.999914
Iteration 14: log likelihood = 15.999917
Iteration 15: log likelihood = 15.999918
    
```