Assessment of the Proposed India-China Free Trade Agreement: A General Equilibrium Approach

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Abstract

Purpose – The present study is an attempt to evaluate the impact of the proposed India-China free trade agreement (FTA) in goods trade on both countries under a static general equilibrium framework.

Design/Methodology/Approach – The study has utilized the Global Trade Analysis Project (GTAP) model of world trade with the presence of skilled and unskilled unemployment in the world. For analysis purposes, 57 GTAP sectors, representing the whole regional economy, have been aggregated into 43 sectors and 140 GTAP regions, representing the whole world, have been aggregated into 19 regions. The study has also used the updated tariff rates provided by the World Trade Organization for better results.

Findings – The preliminary analysis using trade indicators depicted that by utilizing their own comparative advantage, both of the countries can maximize their gains by exporting more to the world. The simulation results from the GTAP analysis revealed that a tariff reduction in all goods trade would be more beneficial for both the countries than the tariff reduction in each other's specialized products. All other regions lose in terms of shifting the Indian imports towards China in a post-simulation environment. Regions with a significant loss are: the European Union (28 members), Southeast Asia, the Unites States, Japan, Korea, West Asia, and the European Free Trade Association (EFTA).

Originality/Value – The disaggregated sector-wise analysis has been performed using the latest available GTAP database, version 9.

Keywords: India, China, free trade agreement, GTAP-9, GTAP model.

Paper type: Research paper

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India and China are part of various trading arrangements in the world and also want to sign a free trade agreement (FTA) with each other. In 2003, both countries established a joint study group to examine the potential for economic engagement between the two countries. In 2007, the report was finalized and the mutual regional trading agreement with each other was recommended. It has also been observed that the proposed FTA between India and China would be beneficial for both the parties. Furthermore, in 2012, these countries again decided to set up a joint working group to look into not only the trade related issues but also the investment issues. In a recent visit of the Chinese President to India, Mr. Xi Jinping has also announced several future investments in railways, industrial parks, and nuclear power in India. Both countries have signed a "five-year trade and economic development plan" with the intention of improving the trade balance of India.

The present study is an attempt to assess the proposed India-China FTA using the static general equilibrium analysis. Using the static model, one can show the gains from any policy shock through the increased efficiency of resource allocation and improved consumption possibilities. The motivation behind the present work is to evaluate the macro-economic effects of the pending India-China FTA on both the partners as well as on the other regions of the world. The present study tries to highlight the gains/losses associated with the tariff liberalization in goods trade by utilizing a general equilibrium (GE) framework. The benefit of using the GE methodology is to evaluate the impact of any change in policy on economy-wide variables. For this purpose, the present study has utilized the Global Trade Analysis Project (GTAP) model of world trade with the presence of skilled and unskilled unemployment in the world. There are many studies that have used the static GTAP model to evaluate the proposed trade agreements by utilizing the older version(s) of GTAP database. Inter alia, some of the studies are those by Faruqui, Ara, and ACMA (2015), Kenichi (2014), Narayanan and Sharma (2014), and Rahman and Ara (2015). The present study enriches the existing literature by using the latest available GTAP-9 database with the data of 2011 reference year. The tariff data of GTAP-9 database have been further updated using current tariff rates provided by the World Trade Organization (WTO)'s tariff download facility for better results.

To pursue the set objectives, the whole study has been divided into five sections. Section 1 introduces the study's objectives and the rationale behind it. The results of some of the existing studies are also given in this section. Section 2 shows the trade and tariff profile of both countries to present an overview of the existing trade pattern and relationships. A preliminary analysis has also been conducted in the same section with the help of calculations of various trade indices. In Section 3, the theory behind the GTAP model is briefly explained, highlighting the theoretical implications of the tariffs reduction on goods trade in GTAP model. It also shows the data aggregations and various scenarios under which the simulations have been conducted. Section 4 presents the simulation results under the simulation scenarios and Section 5 concludes the whole study and provides future research agenda using advanced methodology to evaluate the proposed trade agreement by means of applying the general equilibrium approach.

Literature Review

To the best of our knowledge, in the recent literature, there are some studies that evaluated the impact of the FTA between India and China using a general equilibrium framework. Polaski, Kumar, McDonald, Panda, and Robinson (2008) studied India's trade policy

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choices, as well as the impact of the proposed India-China FTA using a Global model of computable general equilibrium (CGE). The study analyzed various simulation scenarios of unilateral and sector-wise tariff reduction, including a free trade scenario between the two countries. The study found that, in terms of real income, China gains more than India does. In the case of India, the major categories in which exports would increase are other manufacturing industries, chemicals, textiles and apparel, and on the imports side, the major ones would be chemicals, minerals and metals and other manufacturing industries. The FTA would also result in an increase of the demand for unskilled labor in trade, transport, and other services with a smaller increment in construction and textiles, and no change in demand for unskilled labor in agriculture. Agarwal and Ghosh (2011) have also evaluated the impact of the proposed FTA by taking time into consideration. The study has used the Arrow-Debreu dynamic general equilibrium model with two shock scenarios of immediate and gradual tariff removal. The study has used the GTAP-6 database with 2001 reference year and found that a gradual tariff reduction is more beneficial for India, which gives some time to the protected sectors to adjust and minimize the terms of trade loss.

Recently, Mohanty (2014), in his detailed Reserve Bank of India (RBI) report on India-China bilateral trade relationship, conducted a simulation analysis to examine the impact of the proposed FTA between India and China on the Indian economy. Using the GTAP-7 database with the data of 2004 reference year, the study analyzed the unilateral liberalization in the agriculture and manufacturing sectors separately in two different scenarios. The overall analysis revealed that the agricultural liberalization would lead to a negative impact on the sectoral output level, especially on the food grains, processed food, and animal products sector. This policy has also adversely impacted the trade balance of the Indian economy. In the manufacturing sector liberalization, India also lost in terms of economic welfare due to the adverse terms of trade and deteriorating trade balance with the rest of the world. The results in the literature clearly reflect that an immediate reduction of all tariffs would lead to negative gains for India and positive gains for China. However, in the case of a gradual reduction, India may get benefited because its protected sectors may get some time to adjust.

Trade and Tariff Profile of India and China

The initial conditions of any proposed trade agreement can be assessed by evaluating the trade and tariff pattern of the member countries. The trade profile of any country includes its trading relationship with the other trading partners, the main exporting markets, the identification of the products which possess comparative advantage, complementarity of trade with prospective trading partner under the proposed FTA, and the product-wise existing trade shares with bloc member(s), among others. Furthermore, in the tariff profile, the tariff rates of all the member countries have been examined to get an idea about the future prospect of reducing it. In the following two subsections, we present the trade and tariff profile of both the countries.

Trade Profile

Trading Relationship between India and China

Figure 1 presents the engagements of both countries with other regions in the world through the policy of regional trade agreements (RTAs) of the WTO. The table included in

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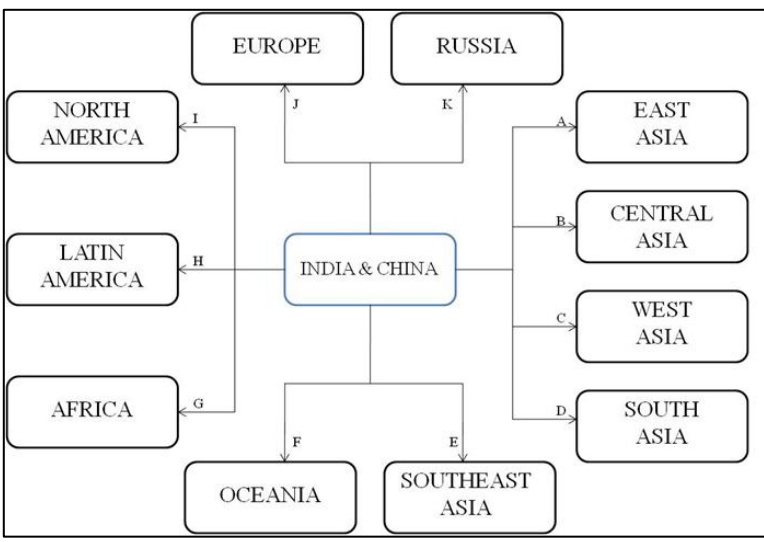
Figure 1 shows the number of trade agreements through which both of the countries are linked with other regions in the world. Column 1 of the table shows the corresponding partner region with which both countries are linked through a trade agreement. Any trade agreement between countries passess through four stages before its implementation. Firstly, an agreement is proposed (*PA*) by the policy makers of member countries and, through joint study groups, its existence is supported and then it is officially signed (*SO*) by the member countries. After the partner countries' approval, negotiations (*NL*) start to concert the items included as positive or negative according to the trade agreement. Finally, after successful negotiations, an agreement is signed and enters into force (*SE*). The table included in Figure 1 presents a stage-wise number of trade agreements through which both countries are linked with other major regions in the world. It is evident from the table that, until now, India is a part of 37[1] such trading arrangements in the world, out of which nine are proposed ones, four are signed, 11 are such in which negotiations have started, and 13 are signed and in force. Moreover, China is the late comer in adopting the policy of RTAs and is currently a part of the 29 trading arrangements in which eight are proposed, seven are such in which negotiations have started, and 14 are signed and in force.



Region	INDIA				CHINA			
	SE	NL	SO	PA	SE	NL	SO	PA
A	3	1	--	3	4	3	--	3
B	--	1	--	--	--	--	--	1
C	--	1	1	--	--	1	--	--
D	6	--	1	--	2	1	--	3
E	3	2	2	1	3	1	--	2
F	--	3	--	1	1	2	--	1
G	--	2	1	--	--	1	--	--
H	2	--	--	4	3	--	--	1
I	--	1	--	--	--	--	--	--
J	--	2	--	1	2	1	--	1
K	--	1	--	1	--	--	--	1
Total	14	14	5	11	15	10	--	13

Figure 1. Region-wise trading arrangements of India & China. Adapted from FTA Database, Asian Development Bank.

Region-wise Trade Shares

While looking at the region-wise trade share of India and China, Asia has maximum participation in both countries' trade. In India's import profile, Asian countries have about 57 percent contribution, followed by Europe (15%), America (13%), Africa (8%), Oceania (2.42%), the Commonwealth of Independent States (CIS)[2], and the Baltic States (2%), and others (1%). On the exports side, about 50 percent of the exports of India are with Asian countries, followed by Europe (19%), America (17%), Africa (10%), others (3%), CIS and the Baltic States (1%), and Oceania (0.86%). On the other hand, in the case of China, the same trend has been followed in terms of percentage share of the region's trade in total trade. In China's import profile, Asian countries have about 56 percent contribution, followed by Europe (17%), North America (9%), Latin America (7%), Africa (6%), and Oceania (5.5%). On the exports side, about 51 percent of

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exports of China are with Asian countries, followed by Europe (18.36%), North America (18%), Latin America (6%), Africa (4%), and Oceania (2%).

Furthermore, Table 1 shows the major export destinations in the world of both the countries, with their ranking in total exports of the respective nations. Among 29 major export destinations, 15 importers are from the Asian region, which indicates the importance of this region in both countries' trade growth.

Table 1
Major Export Destinations with Their Shares in Total Exports of India and China

S.N.	Country	India	China	Region
1.	Australia	0.71 (36)	1.70 (14)	Oceania
2.	Canada	0.69 (37)	1.32 (19)	North America
3.	Japan	2.18 (11)	6.80 (3)	East Asia
4.	Singapore	4.22 (4)	2.07 (12)	South East Asia
5.	United States of America	12.46 (1)	16.71 (2)	North America
6.	Belgium	2.04 (12)	0.70 (28)	EU
7.	Germany	2.40 (10)	3.05 (5)	EU
8.	Spain	0.93 (31)	0.86 (24)	EU
9.	France	1.66 (18)	1.22 (21)	EU
10.	U.K.	3.14 (7)	2.31 (7)	EU
11.	Italy	1.67 (17)	1.17 (22)	EU
12.	Netherlands	2.72 (8)	2.73 (6)	EU
13.	Bangladesh	1.77 (14)	0.44 (36)	South Asia
14.	Hong Kong	4.06 (5)	17.41 (1)	East Asia
15.	Indonesia	1.65 (19)	1.67 (15)	South East Asia
16.	Iran	1.61 (21)	0.64 (29)	West Asia
17.	Korea, Rep.	1.34 (24)	4.13 (4)	East Asia
18.	Sri-Lanka	1.41 (22)	0.16 (58)	South Asia
19.	Malaysia	1.63 (20)	2.08 (11)	South East Asia
20.	Pakistan	0.65 (38)	0.50 (34)	South Asia
21.	UAE	10.09 (2)	1.51 (17)	West Asia
22.	Saudi Arabia	3.67 (6)	0.85 (25)	West Asia
23.	Brazil	1.82 (13)	1.63 (16)	Latin America
24.	Russian Federation	0.72 (35)	2.25 (8)	Russia
25.	South Africa	1.71 (16)	0.76 (27)	SSA
26.	Vietnam	1.78 (15)*	2.20 (9)	South East Asia
27.	Thailand	1.25 (25)	1.48 (18)	South East Asia
28.	India	--	2.19 (10)	South Asia
29.	China	4.88 (3)	--	East Asia

Note. The figures in parenthesis () correspond to the rank. Adapted from RBI Report by Mohanty (2014) and World Integrated Trade Solution (WITS) Database.

Moreover, in terms of bilateral trade relationships, China is ranked 3rd with a share of 4.88 percent in the total exports of India and, as an exporter, China attains the number one position with a share of 11.08 percent in the total imports of India. On the other hand, as an importer, India is ranked 10th with a share of 2.19 percent in the total exports of China and, as an exporter, it is ranked 27th, with a share of 0.87 percent in the total imports of China.

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Product-Wise Bilateral Trade Trends

In addition to the above facts, trends in bilateral trade between India and China can also be used to elaborate trade relations between these two countries. From the Indian side, the merchandise trade balance with China is highly negative to the sum of USD 36 billion in the year 2013-2014. In terms of the number of products traded between the two countries, as an importer India imports 2,974 products and exports 1,200 products at HS 6-digit level of product classification. Table 2 presents the trends in goods trade between India and China from 1995 to 2013 by aggregating all the products into seven-product aggregation using GTAP (see Appendix Table A2 for sectoral aggregation). The results depict that the average annual growth rate (AAGR) of grains and crops, livestock and meat products, and mining and extraction is higher for the Chinese imports from India. Table 2 also depicts that the largest imports of China from India until 2013 are from the mining and extraction sector, with a low Cuddy–Della Valle index value (CDV) among the first three sectors. The CDV is the highest for livestock and meat products because of very low mean value due to many fewer imports over the period of time. The AAGR value in this case is not significant. In total, major items in the Indian exports to China include iron ore, cotton raw and yarn, non-ferrous metals, petroleum (crude products), plastic and linoleum products, other ores and minerals, dyes/intermediates, machinery and instruments, and electronic goods. However, in the case of India, the AAGR is higher for processed food, textiles and clothing, light and heavy manufacturing products, when compared to China. The low CDV of light and heavy manufacturing shows less variation in the value of imports in this two-product group than China. In total, major imports from China include electronic goods, machinery, project goods, iron and steel, organic chemicals, transport equipment, fertilizers, and gold.

Preliminary Analysis through Trade Indicators

The evaluation of any trade agreement requires the preliminary analysis based on some statistical ratios known as trade indicators. There are various indicators based on the values of exports and imports of a country in a given year, but some of them are very much useful to know the likely impact of a proposed trade agreement between countries. The study has calculated four such trade indices, which are helpful in assessing the possibility of any trade agreement between India and China. Those indicators are the Revealed Comparative Advantage (RCA) index, Trade Intensity (TI) Index, Export Similarity (ES) Index, and Complementarity Index (Mikic & Gilbert, 2009). To calculate these indices, the study utilized the data of exports and imports from the World Integrated Trade Solution (WITS) over GTAP classification. Table 3 presents the results of these four trade indicators. Panel-A of Table 3 shows the calculated values of RCA and TI index. The index value of greater than one in the case of RCA implies that the country is having a comparative advantage in that product category. As per the results of RCA index, China has a comparative advantage in nine products whereas India has a comparative advantage over 20 products. However, as for TI index, the value greater than one shows that India is a main exporter to China in the case of eight products and China has dominance in the Indian market in the case of 22 products. It shows that the Indian market is highly dependent upon Chinese products and this dependence will increase after the signing of the FTA.

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Those comparative advantageous products, in which a country has better trade intensity, can play a significant role in increasing the trade between two partners after successfully signing a trade agreement between each other. With regard to India, at GTAP classification, there exist only five such products in which a comparative advantage is present with a better trade intensity. Those products are: plant based fibers (07), vegetable oils and fats (21), food products (25), textiles (27), and leather products (29). On the other hand, in the case of China, these products are eight: textiles (27), wearing apparel (28), leather products (29), wood products (30), mineral products n.e.c. (34), metal products (37), electronic equipment (40), and machinery and equipment (41). These products can play a significant role in enhancing trade between both countries. Moreover, in Panel B, the high value of complementarity index for the year 2013 for both partners also represents the good prospect of trade between the countries. The value of ES index for the same year also illustrates that both partners can use their comparative advantage together to gain the maximum by exporting more to the world together. It is confirmed with the high value of the ES index, which explains that more than 50 percent of the exports of both of the countries to the world are similar. More similarity in the production mix also leads to the chances of more trade creation after signing a FTA between similar partners in terms of exports.

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Table 2
Bilateral Trade between India and China over the Years

Year	Grains & crops		Livestock & meat products		Mining & extraction		Processed food		Textiles & clothing		Light manufacturing		Heavy manufacturing		Total	
	M_I	M_C	M_I	M_C	M_I	M_C	M_I	M_C	M_I	M_C	M_I	M_C	M_I	M_C	M_I	M_C
Panel A: Value of bilateral trade in USD million																
1995	37.10	9.80	87.00	0.80	25.30	98.90	7.20	66.60	27.00	27.80	53.60	25.80	597.10	123.70	834.30	353.40
1996	9.30	29.90	79.60	0.50	22.00	160.80	3.20	208.50	26.00	50.50	46.10	15.10	598.20	210.90	784.40	676.20
1997	10.90	50.90	51.60	4.30	22.80	200.00	2.90	261.40	40.60	62.60	56.30	22.60	861.30	172.10	1,046.40	773.90
1998	26.90	19.00	86.60	1.00	35.60	226.90	4.70	280.50	72.50	59.70	79.60	34.80	785.80	116.70	1,091.70	738.60
1999	89.00	8.40	122.90	3.00	45.70	167.00	37.60	93.90	39.60	68.60	77.10	37.40	840.40	158.60	1,252.30	536.90
2000	27.30	12.80	105.50	2.10	162.30	290.50	5.50	142.20	70.30	81.20	103.20	52.40	1,050.20	378.20	1,524.30	959.40
2001	33.90	18.00	132.00	7.00	211.70	464.30	9.70	125.90	108.30	176.80	131.30	200.80	1,521.10	731.50	2,148.00	1,724.30
2002	85.70	26.40	156.30	3.00	132.40	687.80	3.90	73.70	248.80	84.40	176.50	129.70	2,153.90	1,096.50	2,957.50	2,101.50
2003	41.20	39.50	10.40	0.10	175.00	1,357.20	12.50	68.40	642.60	157.40	193.20	330.90	2,385.50	1,718.00	3,460.40	3,671.50
2004	40.40	79.40	10.20	0.70	457.10	2,957.60	12.80	95.60	1,047.20	194.30	668.20	415.70	4,700.90	1,468.40	6,936.80	5,211.70
2005	37.80	168.90	15.30	0.40	553.80	5,243.20	17.20	185.40	1,389.10	162.20	753.30	457.40	6,412.00	2,653.60	9,178.50	8,871.10
2006	58.90	739.70	9.90	0.60	608.50	4,973.00	48.00	316.80	1,444.40	174.40	1,444.90	530.50	11,686.10	2,749.40	15,300.70	9,484.40
2007	57.80	881.10	9.60	1.30	190.20	8,083.60	61.10	308.30	1,650.60	210.30	2,572.20	745.00	19,601.20	3,193.90	24,142.70	13,423.50
2008	84.80	998.40	13.00	1.10	463.70	14,377.70	97.20	464.80	1,775.00	211.90	3,711.60	222.70	23,199.20	2,751.00	29,344.50	19,027.60
2009	200.90	535.10	10.40	0.10	142.90	8,272.20	46.20	398.30	1,852.90	202.80	4,110.30	1,391.00	21,840.20	3,095.20	28,203.80	13,894.70
2010	173.70	1,870.30	13.90	3.70	134.60	11,971.10	93.30	702.00	2,867.30	490.00	5,411.80	414.00	31,886.60	4,494.20	40,581.20	19,945.30
2011	243.90	2,522.60	28.80	2.40	854.10	10,500.50	201.70	797.40	3,190.30	743.90	8,059.80	655.70	43,533.40	6,060.20	56,112.00	21,282.70
2012	207.60	3,116.80	24.90	6.50	622.00	4,598.70	241.30	644.50	2,966.40	1,313.00	6,579.30	578.70	38,800.90	6,513.60	49,442.40	16,771.80

2013	211.80	2,309.70	13.70	10.90	124.70	2,496.00	116.70	837.20	3,474.70	2,349.70	6,245.90	935.30	37,678.70	6,275.20	47,866.20	15,214.00
Total	1,678.90	13,436.70	981.60	49.50	4,984.40	77,127.00	1,022.70	6,071.40	22,933.60	6,821.50	40,474.20	7,195.50	250,132.70	43,960.90	322,208.10	154,662.50
Panel B: Growth rates in percentage																
AAGR[#]	14.53*	34.94*	-13.11*	3.74	15.48*	27.44*	22.92*	11.17*	31.37*	18.81*	33.56*	22.96*	28.26*	24.40*	27.73*	24.70*
CGR[#]	15.64	41.83	-12.28	3.81	16.74	31.57	25.76	11.82	36.85	20.69	39.87	25.81	32.65	27.64	31.96	28.02
CDV[#]	12.97	16.80	22.86	435.13	16.53	10.79	22.01	10.89	8.76	8.22	6.66	12.02	3.91	6.04	3.41	5.18

Note. M_I: India's Imports from China; M_C: China's Imports from India; AAGR: Average Annual Growth Rate; CGR: Compound Growth Rate; * Represents the value. It is significant at 1 percent level of significance; CDV: Cuddy –Della Valle Index of Variation and it calculated as $CDV = CV \times \sqrt{1-\bar{R}^2}$ (Used to compare the variation among two time-series); CV: Coefficient of Variation; and $\bar{R}^2$ is the adjusted coefficient of determination. Adapted from GTAP-9 Database and #: Authors' Calculations.

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Table 3

Values of Four Trade Indices for India and China for the Year 2013

Panel-A: RCA and TI Index Values

GTAP Code	Description	RCA		TI*		GTAP Code	Description	RCA		TI*	
		India	China	India	China			India	China	India	China
01	Paddy rice	2.15	0.76	0.96	--	22	Dairy products	0.37	0.01	0.00	--
02	Wheat	1.25	0.00	0.04	--	23	Processed rice	17.21	0.06	0.00	--
03	Cereal grains n.e.c.	1.48	0.01	0.40	0.30	24	Sugar	1.56	0.01	0.07	0.30
04	Vegetables, fruit, nuts	1.00	0.44	0.07	1.02	25	Food products	1.18	0.71	1.42	1.64
05	Oil seeds	0.77	0.09	0.02	1.54	26	Beverages and tobacco products	0.24	0.12	0.06	4.72
06	Sugar cane, sugar beet	0.00	0.29	--	--	27	Textiles	2.76	2.72	2.11	1.79
07	Plant based fibers	13.07	0.01	1.39	--	28	Wearing apparel	2.16	3.26	0.58	1.84
08	Crops n.e.c.	2.20	0.37	0.45	0.61	29	Leather products	1.31	2.91	1.12	1.50
09	Cattle, sheep, goats, horses	0.04	0.04	0.00	--	30	Wood products	0.20	1.88	0.36	1.93
10	Animal products	0.21	0.59	0.09	1.74	31	Paper products, publishing	0.28	0.57	0.07	1.61
11	Raw milk	--	--	--	--	32	Petroleum, coal products	3.24	0.20	0.37	4.14
12	Wool, silk-worm cocoons	0.00	0.00	--	0.04	33	Chemical, rubber, plastic products	0.97	0.59	0.66	3.23
13	Forestry	0.61	0.07	0.06	0.71	34	Mineral products n.e.c.	0.77	1.92	1.19	2.28
14	Fishing	1.40	0.37	0.50	0.08	35	Ferrous metals	1.32	0.84	0.87	1.67
15	Coal	0.07	0.07	--	0.00	36	Metals n.e.c.	0.73	0.31	2.12	1.83
16	Oil	0.00	0.01	--	--	37	Metal products	1.01	1.47	0.33	2.17
17	Gas	0.01	0.02	--	--	38	Motor vehicles and parts	0.42	0.30	0.23	3.18
18	Minerals n.e.c.	0.99	0.09	0.94	0.44	39	Transport equipment n.e.c.	1.17	0.85	0.64	1.07
19	Meat: Cattle, sheep, goats, horse	3.86	0.02	0.00	45.53	40	Electronic equipment	0.17	2.83	0.33	1.27
20	Meat products n.e.c.	0.06	0.25	1.52	1.93	41	Machinery and equipment n.e.c.	0.36	1.27	0.46	1.71
21	Vegetable oils and fats	1.70	0.06	1.14	0.01	42	Manufacturers n.e.c.	6.00	2.42	0.71	0.85

Panel-B: Export Similarity and Complementary Index Values

Export Similarity Index		Complementary Index		
0.51	India	39.02	China	43.55

Note. *Trade intensity index has been calculated for each other's market; n.e.c.: Not Elsewhere classified. Authors' calculations.

Tariff Profile of India and China

The tariff profile of any region provides the level of protection of that region over the traded products. A country's level of protection is determined by its own tariff and non-tariff barriers levied on imports from partner countries. It is calculated by evaluating the year-wise average tariff rate over all the products. A higher level of protection of member countries is associated with the significant trade creation and trade diversion effects. Table 4 shows several indicators of the protection level of both countries to all other partner countries in the world. It shows that India's level of protection relative to China under all heads is much higher. If the level of trade between the member countries is very high, then the gains associated with the policy of regional trade agreements depend highly on the protection level of the member countries. A higher level of initial protection or barriers (initial tariff rate and non-tariff barriers) would lead to larger gains afterwards.

Table 4
Indicators of Level of Protection

India **Indicator/Year**	**2009**	**2010**	**2011**	**2012**	**2013**
AVE MFN applied tariff (%) (Simple average at HS-6 digit subheadings)	12.9	13.0	12.6	13.7	13.5
Non-AV MFN applied duties (%) (Share of HS-6 digit subheadings)	5.2	5.2	5.0	4.9	4.9
Maximum duty (%) (Ad Valorem duty)	246	170	315	150	150
Duty free tariff lines (%) (Share of duty free HS-6 digit subheadings)	2.8	2.8	3.5	3.0	2.9
Duty > 15 (%) (Share of HS-6 digit subheadings)	17.1	16.6	16.5	19.6	19.0
Number of MFN applied tariff lines (Country specific)	11360	11359	11377	11477	11471
China **Indicator/Year**	**2009**	**2010**	**2011**	**2012**	**2013**
AVE MFN applied tariff (%) (Simple average at HS-6 digit subheadings)	9.6	9.6	9.6	9.6	9.9
Non-AV MFN applied duties (%) (Share of HS-6 digit subheadings)	0.5	0.5	0.5	0.5	0.3
Maximum duty (%) (Ad Valorem duty)	65.0	65.0	65.0	65.0	65.0
Duty free tariff lines (%) (Share of duty free HS-6 digit subheadings)	7.5	7.4	7.5	7.5	6.9
Duty > 15 (%) (Share of HS-6 digit subheadings)	14.6	14.7	14.6	14.6	15.6
Number of MFN applied tariff lines (Country specific)	7877	7931	7981	7981	8242

Note. AVE: Ad Valorem Equivalent; MFN: Most-Favored Nation; Non-AV: Non-Ad Valorem. Retrieved from World Tariff Profiles (2010–2014).

Furthermore, Table 5 shows the bilateral tariff rates of both the countries using two different databases over GTAP product classification for the year 2011.

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Table 5
Tariff Rates of India and China by GTAP Commodities in Year 2011

GTAP Code	Description	India's tariff rate		China's tariff rate	
		GTAP	WTO	GTAP	WTO
01	Paddy rice	0.00	80.00	0.00	65.00
02	Wheat	0.00	25.00	0.00	65.00
03	Cereal grains n.e.c.	0.00	13.90	1.13	9.75
04	Vegetables, fruit, nuts	35.30	33.70	3.73	13.99
05	Oil seeds	22.04	31.50	10.55	9.53
06	Sugar cane, sugar beet	0.00	30.00	0.00	20.00
07	Plant based fibers	0.87	9.50	4.74	5.44
08	Crops n.e.c.	31.24	33.40	7.76	9.24
09	Cattle, sheep, goats, horses	0.00	30.00	0.00	4.29
10	Animal products	23.28	22.50	9.32	10.45
11	Raw milk	0.00	--	0.00	--
12	Wool, silk-worm cocoons	5.00	9.20	0.00	18.17
13	Forestry	14.08	16.90	5.73	7.26
14	Fishing	15.77	29.20	10.44	10.70
15	Coal	3.44	7.20	0.43	1.00
16	Oil	0.00	7.50	5.55	3.00
17	Gas	0.00	5.00	0.00	0.00
18	Minerals n.e.c.	4.20	4.70	0.04	2.04
19	Meat: Cattle, sheep, goats, horse	15.00	28.60	0.00	15.79
20	Meat products n.e.c.	30.00	35.10	12.00	18.26
21	Vegetable oils and fats	39.58	14.60	7.21	10.44
22	Dairy products	50.12	32.90	3.50	12.04
23	Processed rice	0.00	40.00	0.00	65.00
24	Sugar	59.84	43.80	50.00	35.14
25	Food products	31.94	31.50	6.71	16.53
26	Beverages and tobacco products	99.10	88.70	34.48	23.35
27	Textiles	14.71	9.90	4.71	9.64
28	Wearing apparel	13.43	9.50	12.41	16.26
29	Leather products	9.89	10.00	7.20	14.62
30	Wood products	9.39	9.80	2.64	4.14
31	Paper products, publishing	8.96	8.70	5.47	5.14
32	Petroleum, coal products	7.51	7.60	4.93	5.16
33	Chemical, rubber, plastic products	7.23	8.40	5.41	7.02
34	Mineral products n.e.c.	7.63	9.40	8.06	11.79
35	Ferrous metals	5.59	6.10	2.69	5.11
36	Metals n.e.c.	8.29	5.70	0.18	4.43
37	Metal products	9.30	9.80	8.53	10.36
38	Motor vehicles and parts	12.20	25.20	8.06	14.25
39	Transport equipment n.e.c.	9.65	15.70	4.10	8.44
40	Electronic equipment	1.50	4.50	1.02	5.98
41	Machinery and equipment n.e.c.	7.66	8.00	5.72	8.98
42	Manufacturers n.e.c.	9.08	9.30	3.06	15.97

Source: GTAP-9 database and WTO tariff download facility.

The reason of showing the same year data from two different sources helps to indicate the difference in tariff rates provided by two different databases. The general equilibrium evaluation of the proposed FTA between India and China in the next section used the GTAP-9 database, which provides different tariff rates than the existing one. The study updated the GTAP-9 database with the new tariff rates provided by the WTO tariff download facility and then

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estimated the GTAP model to quantify the effect of tariff liberalization of goods on various macroeconomic variables.

GTAP Model: A General Equilibrium Tool to Assess the Proposed Trade Agreement

The present study utilized the GTAP model (Brockmeier, 1996, 2001; Hertel, 1997), a static multi-region general equilibrium model, which divides the whole economy into various agents that are dependent upon each other. It is static in nature in the sense that it provides a comparison of the state of the economy before and after changing the value of the shock variable and its impact on the economy-wide variables. The framework of this model is provided under the GTAP, which was started in 1992 to aid the researchers working in the area of quantitative analysis of international trade. Under this project, a fully documented database, GTAP database, is also provided, which gives the economy-wide data for all the 140 defined regions in the world. The analysis of trade liberalization and its impact on the economy-wide variables among countries are the main research application of this project. It also provides the software, a tool to implement the GTAP model using the data from the GTAP database. Under the GTAP model framework, each separate region assumes a common domestic structure and the regions are linked through trade and investment flows between them. The domestic structure consists of one regional household specified over private consumption, government consumption, and saving activities; production behavior in the region; and two global sectors through which all the regions of the world are linked with each other. The following subsections briefly explain the domestic structure of a GTAP region and its inter-linkages with the rest of the world as defined in the GTAP model.

Household Behavior

The behavior of a regional household is governed by an aggregated utility function that allocates the expenditure across private, government, and savings activities (McDougall, 2001). In the GTAP model, in each region, the household allocates the regional income so as to maximize the per capita aggregate utility according to the Cobb-Douglas utility function. The utility maximization problem with budget constraint is as follows:

$$\begin{aligned} &\textit{Maximise } U = CU_P^{B_P} U_G^{B_G} U_S^{B_S} \\ &\quad \textit{s.t.} \quad E_P(P_P, U_P) + E_G(P_G, U_G) + P_P U_S = X \end{aligned}$$

where:

U is the per capita aggregate utility of a regional household; U_P, U_G, and U_S are the per capita utilities obtained from private, government, and real savings activities and, at the lower level, these utilities are specified using some expenditure function[3]; E_P and E_G are per capita expenditure functions; P_P, P_G, and P_S are the price vectors for private consumption, government consumption, and savings; B_i is the distribution parameter, which is assumed as variable; and X is the per capita income. The regional household receives income by selling its endowments to the producer and spends over private household expenditure, government expenditure, and savings.

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Producer Behavior

In the GTAP model, the producer tries to minimize the cost of production and his behavior is specified by the nested Constant Elasticity of Substitution (CES) function (Gohin & Hertel, 2003). In case of more than two inputs, Sato (1967) proposed a nested CES function with less restrictive conditions on elasticity of substitution, which is a good approximation for empirical applications. In the GTAP model, the same nested structure has been used to specify the substitution possibilities between various inputs. At the upper level, CES function is defined to indicate the substitution possibility between the intermediate inputs and the value added. At the lower level, the CES function is defined to show substitution between primary factors in the value added nest. The basic idea behind the nested CES structure is to accommodate the substitution possibilities within the aggregated input category, which is composed from other individual inputs. The mathematical structure of nested CES production function with four inputs is given as follows. Suppose x_1 and x_2 are aggregated into one single input and x_3 and x_4 are aggregated into another single input; then, the upper level CES function, which is composed of two lower level CES functions with two inputs each, is as follows:

$$Q = \gamma(\delta CES_1 + (1-\delta)CES_2)^{\frac{-1}{\rho}}$$

where:

$CES_i = \gamma_i(\delta_i x_{2i-1}^{-\rho_i} + (1-\delta_i)x_{2i}^{-\rho_i})^{\frac{-1}{\rho_i}}, i = 1,2$ are the two lower level CES functions. The final specification of the four input nested CES function becomes:

$$Q = \gamma\left[\delta(\delta_1 x_1^{-\rho_1} + (1-\delta_1)x_2^{-\rho_1})^{\frac{\rho}{\rho_1}} + (1-\delta)(\delta_2 x_3^{-\rho_2} + (1-\delta_2)x_4^{-\rho_2})^{\frac{\rho}{\rho_2}}\right]^{\frac{-1}{\rho}}$$

If $\rho_1 = \rho_2 = \rho$, then the above nested CES function becomes a plain four input CES function.

The producer receives incomes from the regional household by selling consumption goods to private and government households, investment goods to savings sector, and intermediate goods to other producers. These incomes are exhausted on the purchase of intermediate goods and primary inputs. Further, in this model, primary factors have been divided into two categories: perfectly mobile and sluggish ones. In case of mobile factors, the reward is the same regardless of the employed sector, but in the case of the sluggish factor, the reward changes with the position of its employment.

Policy Interventions*: *Taxes and Subsidies

The policy interventions in the economy refer to the imposition of taxes by the government on demand and supply activities. Due to the introduction of these transfer payments, there will be changes in the accounting relationships, which are captured by the difference

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between the market prices and the agent's prices. In other words, in this model, taxes and subsidies drive a wedge between the market and the agent's price.

Global Sectors

In a multi-region GE model, there also exist two global sectors through which regions are linked together. In the GTAP model, one global sector is the external sector, which accounts for the international trade and transport activities between the regions. Under this sector, a composite good consists of the exports of commodity, transport, and insurance services, which are produced and used to move in between the regions. The value of these services exhausts the difference between global *fob* exports and global imports at *cif* prices. The demand for domestic product coming from the external sector (other regions in the world) generates additional revenue for the domestic producer and it also provides the additional source of intermediate goods from the outside by paying the import taxes, which is already explained in the policy interventions. As the current GTAP-9 database divides the whole world into 140 regions so as to differentiate the goods from different regions, the model employs the Armington assumption[4] in the trading sector. The model also includes the separate conditional demand equations for private and government consumption for imported commodity. The other global sector is Global Bank, which intermediates between global savings and investments of all regions at same prices. This sector satisfies the regional household's demand for savings by selling shares from the regional investment good assembled for this purpose. In the GTAP model, the implication of this sector is that if all the sectors in a multi-region model are in equilibrium, then the global investments must be equal to global savings to satisfy the Walras' law.

The above-specified GTAP model is easily implemented by using the General Equilibrium Modelling Package (GEMPACK), a suite of economic modeling software developed and provided by the Centre of Policy Studies, Monash University (Harrison, Horridge, Jerie, & Pearson, 2013; and Pearson & Horridge, 2005). The global trade analysis project also provides the simulation software, RunGTAP, which helps in running simulations in a windows environment using the GTAP model. The present study has utilized RunGTAP for simulation purposes and reported the required results for policy analysis.

Welfare Effect

The estimation of the GTAP model provides the regional equivalent variation (*EV*) measure in monetary terms, which represents the welfare effect in this model (Huff & Hertel, 2000). From the household point of view, it measures the cost to the household of the same bundle of goods, before and after a given policy shock. In other words, it is the difference between the expenditure required to obtain the new level of utility at the initial prices and the initial expenditure. In the GTAP model, the regional household utility level depends upon the per capita household consumption, per capita government expenditure, and per capita savings. Any change in this aggregate utility level provides the welfare effect in this model. Consider two policy options, the existing one with prices p^0 and income m^0, and a policy shock with price p^1 and income m^1; then, the equivalent variation can be expressed as:

$$EV = \mu(p^0; p^1, m^1) - \mu(p^0; p^0, m^0) = \mu(p^0; p^1, m^1) - m^0 \quad (1)$$

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where $\mu(p^0; p, m)$, called money metric indirect utility function, measures how much income the consumer would need at prices p^0 to be as well off as he would be if facing price p^1 and having income m^1.

For the GTAP model, McDougall (2001) obtained the EV associated with a perturbation to the GTAP model as follows:

$$EV = Y_{EV} - \overline{Y} \tag{2}$$

where Y_{EV} is the expenditure required to obtain the new level of utility at initial prices, that is equal to $\mu(p^0; p^1, m^1)$ in (1), whereas $\overline{Y}$ is the initial expenditure, that is, m^0 in (1).

Differentiating (2) we obtain:

$$dEV = 0.01 Y_{EV} y_{EV} \tag{2A}$$

where y_{ev} is the percentage change in Y_{EV} required to achieve the current actual utility level, in which the prices are fixed.

Data Aggregations and Simulation Scenarios

For the general equilibrium analysis, the GTAP-9 database with 2011 reference year has been utilized. This is the most suited database used to estimate the GTAP model. It is the latest available database for general equilibrium analysis and it includes data on trade flows, protection variables, and various other required macroeconomic variables. It provides data on 140 regions for all 57 GTAP sectors (Narayanan, Aguiar, & McDougall, 2015). For simulation purposes, one has to aggregate regions and sectors as per the study requirements. In the present study, 140 regions have been aggregated to 19 new regions (Appendix Table A1) and 57 total sectors to 43 new sectors (Table 3). The justification behind this aggregation is that all other regions, except for India and China, are linked with India or China through any trade agreement. Whether it is signed in or yet to be signed, all other regions should be affected by the engagement of India and China into the proposed FTA. Among the total 57 GTAP sectors, 42 sectors belong to the merchandise trade and 15 belong to the services sector. As the study is assuming the tariff liberalization on goods trade only, the 15 services sector is clubbed into one sector (services sector), which makes the total number of sectors to be 43.

Behavioral Parameters

The behavioral parameters in the GTAP model include the Armington elasticities, the factor substitution elasticities, the factor transformation elasticities, the investment parameters, and the consumer demand elasticities (Hertel, McDougall, Narayanan, & Aguiar, 2014). In the GTAP database, the initial estimates of this parameter are given at the user's aggregation. Table 6 shows the important behavioral parameters of consumers and producers in a GTAP region.

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Table 6
GTAP Model Parameters

S.N.	Parameter	Description
1.	ESUBD	EOS between domestic product and imports
2.	ESUBM	EOS between imports from different regions
3.	ESUBT	EOS between composite intermediate inputs and value added in the production of commodity = 0
4.	ESUBV	EOS between primary factors in the production of value added
5.	INCPAR	Expansion parameter in the CDE minimum expenditure function
6.	SUBPAR	Substitution parameter in the CDE minimum expenditure function

Note. EOS: Elasticity of substitution; See Appendix Table A3 for values of these parameters Product-wise for India and China. Retrieved from Chapter 14, GTAP-8 Database Documentation.

Simulation Scenarios

The study has assumed the following four shock scenarios covered under two categories of partial and full liberalization.

a) Partial liberalization scenarios

- 50 percent reciprocal reduction of tariffs on each other's specialized products found in section 2 by the value of RCA index in Table 3.
- 50 percent reduction in tariff rates of all the goods by both of the countries.

b) Full liberalization scenarios

- 100 percent reduction of tariffs on each other's specialized products by both of the countries.
- 100 percent reduction of tariffs on goods trade between India and China from both sides. This simulation represents the India-China FTA in goods.

Simulation Results

The preliminary analysis of the possibility of trade agreement between India and China suggests that it would be feasible for both to be in a trade agreement. After considering this possibility, the present section is devoted to evaluate the impact under various trade liberalization scenarios, defined in the previous section, on both countries using the GTAP model. The results on various economy-wide variables under all simulation scenarios are given in the following two subsections.

Region-Wise Impact

Tables 7 and 8 present the impact of the assumed policy of tariff liberalization by India and China on all the regions of the world defined for the study. Under all the scenarios, the changes in bilateral imports (*DVIWS*) and exports (*DVXWD*) between India and China show a

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positive variation. The level of increment in India's imports from China is very much larger than the China's imports from India. It is also confirmed by the changes in bilateral exports between India and China wherein bilateral exports from China side are larger than the bilateral exports from India. From the Indian side, the bilateral imports from other regions in the study, except for China, showed a negative change, which implies that any policy of trade liberalization between India and China among assumed policies in the study would lead to shift Indian imports in favor of China. Furthermore, the positive change against the total change in imports shows the sign of a new trade generation in favor of China, wherein the reduction of imports from other regions of the world would be less than the increase in imports from China. In simple words, trade shifting will take place under all simulation scenarios. Moreover, the positive figures of bilateral change in exports value show the increase in the exports of India to all other regions, as well. The increase in exports would be helpful in maintaining the overall trade deficit of India, which will be further increased due to larger increase of Indian imports from China than its exports to China. From the Chinese side, the changes in bilateral imports from all other regions show a positive sign, except for the "rest of South Asia" region, under all the assumed scenarios, which shows the sign of a significant trade generation. However, its exports to the other regions in the world show a negative change, showing the sign of trade shifting towards India.

The study has used the terms *trade generation* and *trade shifting* instead of trade creation and diversion because, as per the concept of trade creation, it occurs when trade has been shifted from a less efficient producer of a non-member country to a more efficient producer of a member country. On the other hand, trade diversion would take place when trade is diverted from a more efficient non-member country to a less efficient producer in the member country due to the signing of a preferential trade agreement. These concepts are very difficult to test, as the calculation of the production cost of various tradable commodities in different countries is very difficult. Hence, the terms *trade generation* and *shifting* appropriately represent the study's results. Whenever there will be changes in the tariff liberalization policy, there will be changes in imports and exports. The net positive change in the imports or exports of a country from all regions would be termed as *trade generation* and from the region-wise figures one can estimate the extent of *trade shifting* from one region to the other. The main losers, in the case of India as an importer, in all simulations, would be the European Union, Southeast Asia, the United States of America, Japan, Korea, West Asia, and EFTA.

In addition, the negative value of EV against India under simulation I and III (Tables 7 and 8) shows that India will lose in terms of welfare if both reduce the tariff rates on each other's specialized products. Nevertheless, the value of the same variable for China under the same scenarios shows the drastic increment of welfare. Hence, China will benefit under scenario I and III. On the other hand, under scenario II and IV, both countries would gain in terms of welfare.

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Table 7

Region-wise Impact on Other Macroeconomic Variables

	India				China				For All Regions					
Variables →	DVIWS		DVXWD		DVIWS		DVXWD		tot		qgdp		EV	
Simulation →	I	II	I	II	I	II	I	II	I	II	I	II	I	II
India	--	--	--	--	1535.15	3150.96	7311.91	13231.28	-0.078	-0.090	0.018	0.125	-229.53	1682.72
China	7688.54	14004.54	1451.04	2994.64	--	--	--	--	0.051	0.093	0.041	0.061	4036.76	6235.71
Japan	-442.07	-619.57	17.86	25.75	291.03	356.47	-358.92	-630.64	-0.007	-0.009	-0.002	-0.002	-184.37	-181.04
Korea	-371.45	-663.27	18.63	24.03	211.41	280.63	-210.52	-373.09	-0.007	-0.012	-0.006	-0.011	-101.42	-187.44
Australia	-53.26	-97.12	15.45	21.31	38.74	54.12	-91.03	-166.26	0.001	-0.004	-0.002	-0.007	-14.51	-85.58
New Zealand	-14.23	-19.70	1.33	2.22	7.05	12.61	-11.03	-19.46	-0.006	-0.006	-0.004	-0.004	-8.14	-7.87
Russia	-48.23	-145.78	13.71	24.59	38.04	86.83	-110.54	-206.73	-0.003	-0.017	-0.001	-0.004	-14.24	-126.3
Central Asia	-1.61	-5.10	3.80	5.60	1.87	16.71	-27.03	-50.97	-0.008	-0.024	-0.003	-0.009	-9.86	-40.12
Rest of East Asia	-118.68	-179.42	25.25	31.37	168.95	194.02	-179.53	-322.97	-0.000	- 0.000	-0.001	-0.001	0.51	3.26
South East Asia	-799.53	-1256.48	75.16	118.05	127.84	217.81	-429.78	-735.69	-0.009	-0.014	-0.006	-0.009	-217.1	-332.19
Rest of South Asia	-73.19	-123.32	27.76	55.75	-10.29	-8.26	-58.48	-101.69	-0.018	-0.019	-0.006	-0.006	-50.78	-56.16
West Asia	-236.44	-836.39	186.97	231.95	81.75	280.95	-253.88	-460.81	0.002	-0.012	-0.002	-0.005	30.85	-180.25
USA	-522.62	-945.81	263.53	353.77	128.98	228.27	-1087.28	-1932.44	-0.010	-0.018	-0.006	-0.010	-1111.36	-2047.27
Rest of North America	-55.55	-138.36	23.85	35.35	27.97	46.70	-158.34	-283.14	0.001	-0.001	0.001	0.001	56.58	51.34
Latin America	-46.11	-80.25	48.07	84.21	38.77	49.78	-242.79	-446.51	-0.002	-0.007	0.000	-0.00	17.56	-49.04
EFTA	-272.45	-577.65	13.84	19.40	40.34	58.26	-40.87	-73.18	-0.003	-0.01	-0.006	-0.012	-60.8	-160.51
EU 28	-1685.88	-2455.08	359.69	465.11	406.03	576.41	-1209.63	-2099.81	-0.003	-0.004	-0.004	-0.004	-789.37	-841.37
SSA	-71.94	-238.50	82.96	133.11	32.87	99.69	-157.37	-291.71	-0.002	-0.011	-0.003	-0.007	-34.42	-142.05
Rest of World	-51.34	-201.13	42.54	67.08	12.47	28.31	-135.22	-245.21	-0.001	-0.005	-0.001	-0.002	-23.76	-59.82
Total	2823.98	5421.59	2671.45	4693.27	3178.96	5730.24	2549.66	4790.98	--	--	--	--	--	--

Note. * DVIWS, DVXWD and EV are in USD Mn and tot; qgdp are in percentage change. Authors' calculations using simulation results.

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Table 8
Region-wise Impact on Other Macroeconomic Variables

Variables →	India				China				For All Regions					
	DVIWS		DVXWD		DVIWS		DVXWD		tot		qgdp		EV	
Simulation →	III	IV	III	IV	III	IV	III	IV	III	IV	III	IV	III	IV
India	--	--	--	--	3809.22	7618.83	16194.31	30152.33	-0.170	-0.232	0.025	0.249	-800.65	2979.71
China	17034.53	31931.84	3608.14	7250.05	--	--	--	--	0.111	0.212	0.092	0.134	8924.54	13793.41
Japan	-942.26	-1353.81	38.52	64.41	625.72	782.38	-782.05	-1425.47	-0.015	-0.020	-0.005	-0.005	-405.14	-444.73
Korea	-780.48	-1444.70	40.32	60.79	449.84	606.86	-457.25	-839.15	-0.014	-0.026	-0.013	-0.026	-212.43	-419.34
Australia	-115.36	-214.58	33.89	52.03	91.51	127.51	-197.49	-373.25	0.004	-0.007	-0.004	-0.015	-22.13	-179.78
New Zealand	-29.63	-45.88	2.91	5.42	14.74	28.31	-23.91	-43.78	-0.013	-0.015	-0.009	-0.009	-17.43	-18.67
Russia	-103.41	-319.60	29.81	59.07	84.84	194.35	-240.42	-464.57	-0.007	-0.037	-0.003	-0.010	-29.37	-267.25
Central Asia	-3.42	-11.14	8.27	13.66	6.30	39.39	-58.93	-114.80	-0.018	-0.053	-0.006	-0.020	-20.87	-88.49
Rest of East Asia	-247.43	-381.64	54.75	77.38	337.78	391.89	-393.28	-730.56	-0.001	-0.001	-0.004	-0.004	-8.10	-3.09
South East Asia	-1666.15	-2716.57	162.33	293.11	227.23	434.30	-930.84	-1652.14	-0.020	-0.032	-0.013	-0.018	-455.55	-702.67
Rest of South Asia	-150.63	-271.78	60.53	140.69	-25.61	-20.69	-127.24	-232.01	-0.038	-0.042	-0.013	-0.013	-110.11	-117.73
West Asia	-517.97	-1816.09	407.19	567.70	181.30	622.54	-553.22	-1038.15	0.004	-0.024	-0.003	-0.011	69.67	-349.32
USA	-1112.91	-2067.61	575.85	866.08	278.75	509.67	-2371.22	-4351.91	-0.021	-0.04	-0.013	-0.023	-2456.91	-4561.72
Rest of North America	-117.10	-310.37	52.08	85.73	59.87	104.56	-345.31	-637.26	0.002	-0.003	0.002	0.002	121.39	115.09
Latin America	-96.20	-177.04	105.11	202.34	81.59	116.91	-530.47	-1006.59	-0.005	-0.014	0.000	-0.001	26.38	-115.60
EFTA	-599.02	-1266.09	30.24	47.92	87.31	127.76	-88.87	-164.14	-0.006	-0.021	-0.012	-0.026	-134.25	-346.32
EU 28	-3590.64	-5376.12	788.59	1143.54	866.63	1268.50	-2628.13	-4723.88	-0.006	-0.008	-0.008	-0.008	-1702.34	-1856.46
SSA	-156.78	-535.39	181.25	319.23	76.17	227.91	-342.78	-658.00	-0.004	-0.023	-0.006	-0.016	-72.36	-301.03
Rest of World	-107.77	-436.86	92.95	163.25	26.69	62.86	-294.21	-552.72	-0.003	-0.012	-0.003	-0.005	-53.18	-131.32
Total	6697.37	13186.57	6272.73	11412.39	7279.87	13243.83	5828.71	11143.94	--	--	--	--	--	--

Note. * DVIWS, DVXWD and EV are in USD Mn and tot, qgdp are in percentage change. Authors' calculations using simulation results.

Sectoral Analysis

We have seen that, in scenarios I and III, India will be at loss in terms of welfare. In addition, the total change in the volume of output will be negative. Hence, from the point of view of India, the policy covered under these scenarios should not be chosen.

Table 9
Sector-wise Impact on Volume of Output and Bilateral Imports

Sector	Variable Name →	India				China			
		DQO		DVIWS		DQO		DVIWS	
	Simulation→	II	IV	II	IV	II	IV	II	IV
1.	Paddy rice	10.96	41.25	0.37	4.77	7.58	-8.02	2.44	18.40
2.	Wheat	15.34	37.64	0.03	0.13	3.09	1.83	0.56	7.15
3.	Cereal grains	5.46	10.78	0.05	0.10	4.80	9.38	5.06	11.07
4.	Vegetables, fruits & nuts	-70.76	-196.88	138.04	398.73	138.13	375.53	3.73	8.84
5.	Oil seeds	92.44	231.81	1.22	3.94	-47.84	-109.33	18.61	42.74
6.	Sugar cane & sugar beet	7.86	19.35	0.00	0.01	-2.01	-5.75	0.12	0.33
7.	Plant based fibers	216.03	473.69	1.60	3.72	-90.66	-197.15	242.96	511.11
8.	Crops n.e.c.	-9.73	-48.42	64.82	231.06	17.94	83.44	15.91	38.04
9.	Cattle, sheep, goats & horses	30.21	72.70	0.00	0.01	-8.90	-24.06	0.02	0.04
10.	Animal prods. n.e.c.	13.57	32.10	4.15	9.92	82.72	174.28	0.54	1.19
11.	Raw milk	8.54	-3.35	0.00	0.00	12.21	39.95	-0.01	0.02
12.	Wool, silk-worm cocoons	4.00	20.18	9.84	26.93	-13.88	-35.94	6.57	27.71
13.	Forestry	-5.10	-10.57	10.85	27.91	-22.48	-51	2.72	6.13
14.	Fishing	7.82	13.48	0.50	1.29	27.92	62.52	2.66	5.88
15.	Coal	4.92	12.41	12.39	28.1	42.70	92.50	0.13	0.27
16.	Oil	5.21	14.89	73.79	184	-45.38	-100.16	0.00	0.00
17.	Gas	0.18	0.90	0.00	0.00	-0.46	-1.02	0.00	0.00
18.	Minerals n.e.c.	130.54	273.82	11.61	24.15	50.22	114.47	196.09	401.51
19.	Meat: Cattle, sheep, goats & horse	8.93	25.16	0.41	1.59	-13.25	-31.96	0.19	0.56
20.	Meat prods.	-1.24	-6.68	4.08	17.85	-4.61	-12.36	1.29	4.25
21.	Vegetable oils & fats	181.86	454.01	64.09	170.19	-76.23	-169.91	241.27	587.01

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Sector	Variable Name →	India				China			
		DQO		DVIWS		DQO		DVIWS	
	Simulation→	II	IV	II	IV	II	IV	II	IV
22.	Dairy prods.	5.93	-17.15	22.59	88.43	28.02	98.33	3.01	7.92
23.	Processed rice	24.27	74.59	0.18	0.65	0.21	-14.42	8.28	46.73
24.	Sugar	13.30	34.78	0.14	0.56	-4.56	-12.66	5.46	19.92
25.	Food prods. n.e.c.	50.93	106.59	60.00	169.43	54.81	136.38	62.08	153.51
26.	Beverages & tobacco prods.	4.85	-2.70	14.16	53.02	110.27	263.08	1.44	3.49
27.	Textiles	-120.15	-122.83	849.18	1,884.52	-122.19	-423.78	294.61	732.69
28.	Wearing apparel	221.57	559.24	50.25	114.10	-353.13	-821.09	59.30	172.44
29.	Leather prods.	80.88	271.10	199.15	441.64	-300.95	-730.69	95.62	275.83
30.	Wood prods.	-92.41	-201.03	177.43	396.12	-196.06	-451.91	3.04	6.70
31.	Paper prods. & publishing	-18.02	-35.36	120.37	273.44	63.66	133.84	1.88	4.18
32.	Petroleum & coal prods.	-15.98	-13.66	295.46	643.04	566.00	1,233.19	20.71	44.50
33.	Chemical, rubber & plastic prods.	88.88	393.48	2,860.12	6,363.84	1,685.38	3,635.88	569.96	1,330.74
34.	Mineral prods. n.e.c.	-130.87	-268.2	290.60	635.32	454.19	974.06	42.93	106.12
35.	Ferrous metals	-205.23	-416.77	433.50	931.01	806.06	1,793.13	142.88	315.85
36.	Metals n.e.c.	301.24	713.09	630.34	1,416.67	323.41	714.03	402.53	908.88
37.	Metal prods.	-579.49	-1,271.08	906.55	2,011.28	586.06	1,276.03	43.28	110.33
38.	Motor vehicle & parts	-68.12	-289.85	477.51	1,373.32	616.00	1,778.63	33.88	87.84
39.	Transport equip. n.e.c.	-410.56	-1,080.54	953.51	2,403.06	722.44	1,887.33	4.95	12.57
40.	Electronic equip.	-225.03	-376.42	1,293.66	2,669.50	-1,716.63	-4,181.00	82.23	196.52
41.	Machinery & equipment n.e.c.	-888.53	-1,848.69	3,677.16	8,226.94	1,370.50	3,021.63	295.48	745.82
42.	Manufacturers n.e.c.	484.81	1,270.25	303.43	722.24	-321.19	-757.69	213.16	606.83
43.	Services sectors	1,912.63	4,189.25	-8.62	-20.69	5178.00	11,389.00	23.40	57.16
	Total	1,091.94	3,136.36	14,004.54	31,931.85	9,611.91	21,148.54	3,150.96	7,618.83

Note. DQO: Change in Quantity of Output in Volume; DVIWS: Change in Value of Imports at World Prices in USD Million. Authors' calculations using simulation results.

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Hence, the sectoral results for India and China are given only for scenarios II and IV in Table 9. The aggregated sectors in which the Indian imports from China will increase are: heavy manufacturing, light manufacturing and textiles, and clothing. As for China, those major sectors are heavy and light manufacturing items, textiles and clothing, plant based fibers, and minerals. Furthermore, while comparing the increase in output with the increase in bilateral imports, the study found that in both scenarios the sectors in which the output of one partner will increase *vis-a-vis* imports of the other partner are: (a) in the case of India, sectors 7, 18, 21, 25, 28, 29, 33, 36, and 42; and (b) in the case of China, sectors 4, 33, 34, 35, 36, 37, 38, 39, and 41 (Table 3).

Conclusions and Future Work

Any trade agreement between the member countries is associated with various gains and losses and the present study is an endeavor to evaluate the trade potential of goods between India and China under various conjectures of trade liberalization. A detailed sector-wise analysis has been done using the latest available database, GTAP-9, which is the real contribution of this study towards empirical research in the area of quantitative analysis of international trade. The empirical results, based on the calculation of trade indices, show that specialized products with better trade intensity can play a significant role in enhancing the trade between both countries. The results also depict that by using their own comparative advantage together both countries can gain maximum by exporting more to the world. Furthermore, on the basis of the simulation results using the GTAP model, the study concluded that tariff reduction in all goods trade would be more beneficial for both countries than tariff reduction only in the case of each other's specialized products. It also shows that the policy of tariff liberalization by both the countries will lead to increase the bilateral trade between the two countries with an increasing trade deficit of India from China only. Apart from India's increase in trade, deficit will automatically be wiped out by increasing India's exports to the other regions in the world. The results of the study may help the negotiators to finalize the discussions between the two member countries so that both of them will get benefits at the end.

The main limitation of the present study is the usage of the static general equilibrium model of trade to get the general equilibrium assessment of the proposed trade agreement with the data of 2011 reference year. The simulation results can be improved by using the dynamic GTAP model (Ianchovichina & Walmsley, 2012), which can answer important policy questions, such as: long-run impact of change in policy variable(s) on member economies and the time required to reach at the stage wherein each member country will eliminate all tariffs on other member country's exports, among others.

Endnotes

1. There also exist some agreements which cover more than one region, as defined in Figure 1, and make the total number of trade agreements to 44 for India and 38 for China (Table in Figure 1) instead of 37 and 29 in total for India and China, respectively.
2. As per the data provided by the Ministry of Commerce and Industry, the CIS countries also include all Central Asian countries and have 0.16% and 0.17% shares in the total imports and exports of India, respectively, during 2013-2014, which does not affect the total figure while explaining the required fact.

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3. The government consumption expenditure (EG) system is governed by the Cobb-Douglas utility function with constant expenditure shares over all goods; the private consumption expenditure (EP) system is modeled by using CDE implicit expenditure function and is non-homothetic given by Hanoch (1975); and the third component of the final demand system, i.e., savings (ES), is a single commodity and fully exhausted by the investment demand.

4. As per this assumption, products of the same industry, produced in different countries are distinct but substitute to each other. In the GTAP model, the elasticity of substitution between domestic and imported goods and the elasticity of substitution among imports of different destinations are defined in the Armington aggregation structure for all agents in all the regions.

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Appendix A

Table A1
Region's Aggregations

S.N.	Region	Description	S.N.	Region	Description
1.	India	India	11.	New Zealand	New Zealand,
2.	China	China	12.	USA	United States of America
3.	Japan	Japan	13.	Russia	Russian Federation
4.	Korea	Korea	14.	Central Asia	Kazakhstan, Kyrgyzstan, Rest of former Soviet Union
5.	Rest of South Asia	Bangladesh, Nepal, Pakistan, Sri Lanka, Rest of South Asia	15.	Rest of North America	Canada, Mexico, Rest of North America
6.	Rest of East Asia	Hong Kong, Mongolia, Taiwan, Rest of East Asia	16.	EFTA	Norway, Switzerland, Rest of EFTA
7.	South East Asia	Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Philippines, Singapore, Thailand, Vietnam, Rest of Southeast Asia	17.	West Asia	Armenia, Azerbaijan, Bahrain, Georgia, Iran, Israel, Jordan, Kuwait, Oman, Qatar, Saudi Arabia, UAE, Rest of Western Asia
8.	SSA	Benin, Botswana, Burkina Faso, Cameroon, Central Africa, Cote d'Ivoire, Ethiopia, Ghana, Guinea, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Nigeria, Rwanda, Senegal, South Africa, South Central Africa, Tanzania, Togo, Uganda, Zambia, Zimbabwe, Rest of Eastern Africa, Rest of South African Customs, Rest of Western Africa,	18.	Latin America	Argentina, Bolivia, Brazil, Caribbean, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Jamaica, Nicaragua, Panama, Paraguay, Peru, Puerto Rico, Rest of South America, Trinidad & Tobago, Uruguay, Venezuela, Rest of Central America
9.	EU 28	Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom	19.	Rest of World	Albania, Belarus, Egypt, Ukraine, Morocco, Rest of Eastern Europe, Rest of Europe, Rest of Oceania, Rest of North Africa, Turkey, Tunisia, Rest of the World
10.	Australia	Australia			

Note. SSA = Sub-Saharan Africa; EU 28 = The European Union with 28 countries; EFTA = The European Free Trade Association. Retrieved from the GTAP-9 database documentation (Chapter 2).

Table A2
Sectoral Aggregations

S.N.	New Sector	GTAP Sectors*	S.N.	New Sector	GTAP Sectors*
1.	Grains & crops	1+2+3+4+5+6+7+8+23	5.	Textiles & clothing	27+28
2.	Livestock & meat products	9+10+11+12+19+20	6.	Light manufacturing	29+30+31+37+38+39+42
3.	Mining & extraction	13+14+15+16+17+18	7.	Heavy manufacturing	32+33+34+35+36+40+41
4.	Processed food	21+22+24+25+26	8.	Services	43 to 57

Note. *For the sector description, see Table 3 in the main text of the present study. Retrieved from the GTAP-9 Database Documentation (Chapter 2).

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Table A3
Product-wise Values of Behavioral Parameters Used

GTAP Code	ESUBD	ESUBM	ESUBV	INCPAR		SUBPAR	
				India	China	India	China
1	5.05	10.10	0.26	0.50	0.26	0.84	0.82
2	4.45	8.90	0.26	0.50	0.26	0.84	0.82
3	1.30	2.60	0.26	0.50	0.26	0.84	0.82
4	1.85	3.70	0.26	0.50	0.26	0.84	0.82
5	2.45	4.90	0.26	0.50	0.26	0.84	0.82
6	2.70	5.40	0.26	0.50	0.26	0.84	0.82
7	2.50	5.00	0.26	0.68	0.50	0.79	0.71
8	3.25	6.50	0.26	0.50	0.26	0.84	0.82
9	2.00	4.00	0.26	0.69	0.51	0.79	0.71
10	1.30	2.60	0.26	0.69	0.51	0.79	0.71
11	3.65	7.30	0.26	0.69	0.51	0.79	0.71
12	6.45	12.90	0.26	0.68	0.50	0.79	0.71
13	2.50	5.00	0.20	0.79	0.93	0.77	0.58
14	1.25	2.50	0.20	0.69	0.51	0.79	0.71
15	3.05	6.10	0.20	0.98	1.03	0.73	0.56
16	5.20	10.40	0.20	0.94	0.87	0.74	0.59
17	17.20	34.40	0.20	0.98	1.03	0.73	0.56
18	0.90	1.80	0.20	0.79	0.93	0.77	0.58
19	3.85	7.70	1.12	0.69	0.51	0.79	0.71
20	4.40	8.80	1.12	0.69	0.51	0.79	0.71
21	3.30	6.60	1.12	0.62	0.43	0.81	0.75
22	3.65	7.30	1.12	0.69	0.51	0.79	0.71
23	2.60	5.20	1.12	0.50	0.26	0.84	0.82
24	2.70	5.40	1.12	0.62	0.43	0.81	0.75
25	2.00	4.00	1.12	0.62	0.43	0.81	0.75
26	1.15	2.30	1.12	0.62	0.43	0.81	0.75
27	3.75	7.50	1.26	0.68	0.50	0.79	0.71
28	3.70	7.40	1.26	0.68	0.50	0.79	0.71
29	4.05	8.10	1.26	0.68	0.50	0.79	0.71
30	3.40	6.80	1.26	0.79	0.93	0.77	0.58
31	2.95	5.90	1.26	0.79	0.93	0.77	0.58
32	2.10	4.20	1.26	0.94	0.87	0.74	0.59
33	3.30	6.60	1.26	0.79	0.93	0.77	0.58
34	2.90	5.80	1.26	0.79	0.93	0.77	0.58
35	2.95	5.90	1.26	0.79	0.93	0.77	0.58
36	4.20	8.40	1.26	0.79	0.93	0.77	0.58
37	3.75	7.50	1.26	0.79	0.93	0.77	0.58
38	2.80	5.60	1.26	0.79	0.93	0.77	0.58
39	4.30	8.60	1.26	0.94	0.87	0.74	0.59
40	4.40	8.80	1.26	0.79	0.93	0.77	0.58
41	4.05	8.10	1.26	0.79	0.93	0.77	0.58
42	3.75	7.50	1.26	0.79	0.93	0.77	0.58
43	1.94	3.85	1.36	1.40	1.36	0.67	0.51

Source: Retrieved from the GTAP-9 database.

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