Can India plug into Asian International Production Networks through RTAs?

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Abstract

Recent literature has focused attention on the important question of whether the current trend of proliferation of bilateral and regional trade agreements can facilitate creation and development of international production networks (IPNs) among member countries. However, majority of these adopt a partial equilibrium approach, thus ignoring the economy wide impact. As India gets increasingly integrated through calibrated globalization of its economy over the past two decades and creates a web of such trade agreements, this paper attempts to specifically analyze the effect of recent RTAs involving India on its ability to plug into IPNs in Asia by changing international trade and production patterns. The auto-parts industry, identified as one of the high-growth sectors for India's manufacturing sector, with a potential to integrate into existing Asian IPNs, is chosen for this analysis.

The paper reviews the current state of India's participation in Asian IPNs identifying the policy challenges, and further undertakes an applied general equilibrium analysis of the above issue by utilizing the GTAP 8 database based on 2004 data to simulate the impact of tariff reduction in auto-parts for India's currently implemented FTAs with ASEAN, Japan, Korea and EU. Additional scenarios of a productivity improvement along with reduction in trade costs along with the RTA, are also explored. The paper analyses the impact of these policy shocks on output, prices and trade volumes ,as well as their impact on overall welfare changes across all regions.

The results point to the evidence that India that there are significant gains for India and its trading partners through export expansion and welfare improvements from better resource allocation not from an RTA alone, but from productivity improvement and reductions in trade costs as this should not only reduce border trade costs, but also network costs set up for an IPN.

Keywords: India, International Production Networks, Regional Trade Agreements, GTAP model, productivity, trade costs

JEL Classification : F15, F61, O53

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1. Introduction

Rapid globalization over the past two decades involving trade and investment liberalization has broadened the scope of firms to slice up their value chains and create cost-based advantages through marginal differences in costs, resources, logistics and markets. This has led to creation of International production networks (IPNs)[1] that provide opportunities for participating countries to gain access to markets and benefit from technology transfer through Foreign Direct Investment (FDI).[2] In the Asian context, such IPNs have been created by multinationals in labour-intensive manufacturing industries such as automobiles and electronics in China, Republic of Korea, Singapore, Malaysia, Thailand and Indonesia and other East and South-East Asian countries, with increasing share of intra-industry trade in machinery parts and components involving these countries[3]. An adoption of export-led outward oriented growth strategy involving Foreign Direct Investment (FDI) by these countries since the decade of 1980s, played a major role in fuelling the development of these IPNs, wherein foreign-owned affiliates were involved in intra-firm and therefore intra-industry (IIT) trade transactions, wherein the finished goods in producer-driven chains tend to be mainly supplied by multinationals in core countries (Gereffi, 2001).

[1] See Rajan, 2003, Hummels *et al*. (2001), Yi (2003), Krugman 1995, Ng and Yeats 2001, 2003 and Grossman and Helpman 2005).

[2] See McKendrick et.al (2000) , Kuroiwa and Toh (2008) and Fujita (2007).
[3] See Athukorala and Yamashita, 2005; Ando, 2006.

In contrast to the above experience, India was largely left out of these Asian IPNs in the1980s and early 1990s due to its late adoption of outward-orientation and unilateral reduction of trade barriers and involving a "calibrated" globalization compared to East Asia. India's IIT during this period was being negatively influenced by market-seeking nature of its inward FDI in the domestic industries (Veeramani, 2009). However, its impetus to economic reforms in the form of trade and investment liberalization measures over the past decade, both regionally and bilaterally allowing greater integration with the global economy, have generated debate among policymakers as to whether India could successfully plug into Global and Asian IPNs in the near future and the sectors that hold such a potential. Such possibilities are being analyzed in the wake of India's look-east policy and its integration with South-east and East Asia through recent proliferation of bilateral and regional preferential trade agreements (RTAs)[4]. Asia (including ASEAN) is now India's largest export destination accounting for 55 per cent of total exports, compared to just 40% in 2001-02[5].

As India gets increasingly integrated through calibrated globalization of its economy over the past two decades and creates a web of such trade agreements, this paper attempts to specifically analyze the effect of recent RTAs involving India on its ability to plug into IPNs in Asia by changing international trade and production patterns. The auto-parts industry is chosen for this analysis as this has been identified as one of the high-growth and rapidly liberalizing sectors for India's manufacturing sector, with a

[4] The deadlock in multilateral trade negotiations and rise of new regionalism in Asia has prompted Asia-Pacific countries including India to become very active in negotiating and entering into bilateral and regional PTAs. As of June 2011, it has implemented 12 PTAs and is currently negotiating or proposing many more of such agreements (UNESCAP, 2011a and b).[4] India's PTA activity is therefore now comparable with that of the other major Asian countries that are strongholds of IPNs, viz. China and Japan.

[5] See Rajan and Gopalan, (2011)

potential to integrate into existing Asian IPNs, and develop as a hub for global exports (Badri Narayanan and Vashisht, 2008; Sen and Srivastava, (2011, 2012), Srivastava and Sen (2011) ; Nag, 2011).

Recent literature has focused attention on the important question of whether the current trend of proliferation of bilateral and regional trade agreements can facilitate creation and development of international production networks (IPNs) among member countries. Since policies that impact upon the costs of building an IPN relate to removing cross-border barriers, as well as reducing behind-the border impediments to trade and investment, it can be argued that the impact of RTAs on policies affecting the participation of countries in production networks is very much dependant on the extent of comprehensive coverage of an RTA and the extent to which they focus on areas that would deepen regional integration through production networks (Orefice and Rocha, 2011 and Hew et. al., 2009). Thus, PTAs that emphasize only on liberalizing trade in goods and tariff reduction are likely to impact positively on policies to overcome geographical distance and border effects, and thereby reduce service-link costs in production network, while not being able to reduce network-set up or production costs (Sen and Srivastava, 2012, Table 14). In the context of India, this implies that it's PTAs with Asian IPN members (viz. ASEAN countries, China, Japan and Korea), when fully implemented, can potentially facilitate to lower service-link costs and thereby enhance India's participation in Asian manufacturing production networks through expansion of intra-industry trade in parts and components (both on the export and import side). They can do so by taking advantage of their relative abundance of unskilled labour when compared to more developed Asian IPN member countries.

It is observed that there have been very limited studies in this area. While Sen and Srivastava (2011 and 2012) and Srivastava and Sen (2011) provide a comprehensive analysis of intra-industry trade in parts and components for India's manufacturing trade over 1994-2008 identifying the potential sector for India to plug into Asian IPNs, it does not analyse the welfare impact of RTAs. Narayanan et.al (2010), is the only study that specifically analysed the effect of tariff liberalization in the Indian automobile industry using an applied general equilibrium analysis, but does not specifically focus only on auto-parts. This paper fills the gap in the literature by undertaking an applied general equilibrium analysis utilizing the Global Trade Analysis Project (GTAP) version 8 database based on 2004 data to simulate the impact of tariff reduction in auto-parts for India's currently implemented FTAs with ASEAN, Japan, Korea and the EU, with an additional scenario of a productivity improvement which has never been attempted before in the GTAP context[6]. This approach allows to analyze the economy wide welfare impacts of such an RTA on the service link costs that are integral to creation of an IPN, and also provides insights on the impact of such an RTA in the presence of technological improvements modeled through a productivity shock.

The simulation involves a 19x7 regional and sectoral aggregation from the original GTAP 8 database, which is based on a multi-regional AGE model which captures world economic activity in 57 different industries of 129 regions. The regions are disaggregated into India and its major export and import destinations (including RTA

[6] Although GTAP 8 also contains 2007 data, this is not used in this analysis as the corresponding disaggregating tool for tariff reduction, Tariff Analytical and Simulation Tool for Economists (TASTE) is only available yet for 2004 data.

partners) over 2004-2009[7], while the sectoral aggregation involves a disaggregation of the manufacturing sector, and more specifically, the motor vehicles and parts sector.

The remainder of this paper is organized as follows. Section 2 reviews the current state of India's participation in Asian IPNs identifying the policy challenges. Section 3 analyzes the modeling framework and methodology. Section 4 identifies the policy scenarios and details of the simulations. Section 5 analyzes the results and related policy implications, while Section 6 concludes the paper.

2. Improving India's participation in Asian IPNs : The current state and Policy challenges[8]

2.1 Empirical evidence on current state of India's participation in Asian IPNs

The empirical analysis for estimating production fragmentation and hence participation in IPNs, involves separation of the data on parts and components (that proxy for production fragmentation) from the reported trade data as observed by Athukorala and Yamashita (2005) in the East Asian context. Sen and Srivastava (2012) undertake an inter-temporal comparison of trade patterns for the period 1994, 1999 2004 and 2005-2008 utilizing the same approach, analyzing parts and components (P/C) trade identified at the 5-digit level for SITC 7 and 8 products from the UN Comtrade database, that contains a total of 231 products, with 172 products belonging to SITC 7 and 59 belonging to SITC 8 category of manufactured goods. They then estimated IIT in P/C trade in India by first separating India's total P/C trade into one-way trade and two-way trade that

[7] The regions would mainly include the major export destinations of India and its major RTA partners These include China, Indonesia, Japan, Korea, Thailand, Malaysia, Singapore, Vietnam, Bangladesh, Sri Lanka and UAE. Besides these countries, the regions would therefore include NAFTA and EU as a regional grouping.

[8] This section largely draws on Sen and Srivastava (2012)

involves intra-industry trade involving trade in fragmented production chains, and then analyzing estimates of marginal IIT for top 20 products involving two-way IIT as suggested by Brülhart (1994) to ascertain whether the change in trade volumes in these P/C manufacturing products over the time periods analyzed are more due to intra-industry or inter-industry trade. They observed that one of the products (SITC 78439) that constituted the highest share of India's P/C exports (17.5%) as well as highest levels of IIT in 2004, also showed a continuous increase in IIT at the margin, indicating that there is a clear trend of emergence of production fragmentation in this product category, which involves automobile parts.

2.1.1 The trends of IPN participation in Indian auto-parts industry

India exported about 13 per cent of its auto-components in 2010-11, which was worth US$ 5.2 billion and is expected to grow by 20-25 per cent in 2011-12. This industry witnessed a C.A.G.R of 21 per cent in its exports from US $ 1.3 billion in 2003-04. Principal export items included replacement parts, tractor parts, motorcycle parts, piston rings, gaskets, engine valves, fuel pump nozzles, fuel injection parts, filter & filter elements, radiators, gears, leaf springs, brake assemblies& bearings, clutch facings, head lamps, auto bulbs & halogen bulbs, spark plugs and body parts (ACMA, 2011). Europe has been the largest destination for Indian auto-parts exports in 2010-11 with a share of 36 per cent, with nearly 24 per cent destined for North America and 28 per cent exported to Asian countries in the same period. A majority of exports to Europe has constituted of sourcing of auto-parts by European based automobile OEMs such as BMW, Volkswagen, Fiat Renault and Mercedes Benz. During the same period, 54 per cent of India's auto-components imports were from Asia, followed by Europe (36 per cent) and North

America (8 per cent), suggesting that currently India is a net importer of auto-components from Asia, while being a net exporter to Europe and North America.

Over 2000-2011, the automobile industry (including auto-components) has been the 6th largest recipient of FDI equity inflows in India, receiving a cumulative FDI inflow worth US$ 6.4 billion over April 2000-September 2011, constituting a share of 4 per cent of the total (DIPP, 2011) . However, data is unavailable on the contribution of MNEs in this industry by their country of origin[9], which makes it impossible to ascertain whether Asian or non-Asian MNEs have been playing the dominant role in FDI in this industry, and more particularly in the sub-sector of auto-components. However, the current structure of the industry suggests that in 2010, the organized sector in this industry contributed to 58 per cent of the total production, with large Indian firms[10] contributing 43 per cent of the total production, while MNEs such as Magna, Visteon, Federal-Mogul Corporation (North American based), Valeo, Bosch (European based), and Denso (Japan-based) contributed 15 per cent of the production in the Indian auto-components market, with the remaining contributed by the unorganized sector, suggesting that compared to South-East and East Asia, the role of Asian MNEs in India's auto-components industry has been minimal, but their presence is visible and growing (IBEF, 2011).

Nag (2009) and (2011) analyzed the growth in auto-components industry in Asia and the potential for India to integrate with existing IPNs in Asia. Nag (2009) observed that globalization of the auto-components industry and its liberalization had a positive impact

[9] Monthly FDI Statistics published by the Department of Industrial Policy and Promotion, Government of India provides detailed data on aggregate country-wise FDI equity inflows, or by industrial sectors, but not both.

[10] These include firms such as Bharat Forge Ltd, Sundaram Fasteners Ltd.,Lucas-TVS Ltd, Rico Auto, Pricol Ltd and Shriram Piston and Rings Ltd.(IBEF, 2011).

on growth of the automobile industry in Asia. Over 1995-2006, India's exports of auto-components increased by nearly five-fold from US $ 0.28 billion to US $ 1.38 billion. In contrast, China's auto-components exports increased from US $ 0.38 billion to 8.93 billion, during the same period, indicating that India's scale of production has been growing but at a much lower scale when compared to major Asian IPN destinations such as China.

Majority of India's auto-components exports is destined for UK, USA, Italy, Germany, Mexico, Bangladesh, Sri Lanka and the Middle East countries. This is in contrast with the pattern of other Asian economies such as Thailand, Malaysia, Indonesia where Japan, China and Taiwan has been the major export destinations for their auto-parts , reflecting strong participation in an Asian IPN in this industry. Nag (2011) noted that while majority of India's auto-exports is not destined for Asia, it is increasingly sourcing a significant amount of auto-components from Asia. This suggests that India's level of participation in Asian IPN in this industry is currently quite low when compared to East and South-East Asia, and probably involves more of one-way than two-way trade in auto-components. This is further confirmed by an analysis of IIT in auto-parts for India at the HS eight digit classification by Nag (2011) involving OECD countries such as US, Germany, UK, Italy and Asian economies, viz. China, Malaysia, Indonesia and Thailand, wherein bilateral IIT is observed to be highest for India's trade in auto-parts with US and Germany, in 2007-08.

Table 1 based on Sen and Srivastava (2012) that presents the trends in India's automobile P/C exports to major Asian countries involved in an IPN over 1994, 1999, 2004 and 2008, suggests that the share of India's automobile P/C exports to eight major

auto-component producers in Asia increased from 6.3% in 1994 to 10.8% in 2008, with major expansion in value and share of exports to Republic of Korea, Thailand, China and Japan respectively.

Table 1

India's Exports of Auto-parts to major countries involved in Asian automobile IPNs, 1994-2008

	1994		1999		2004		2008	
	Value (US $ Mn)	**Share in Total (%)**	**Value (US $ Mn)**	**Share in Total (%)**	**Value (US $ Mn)**	**Share in Total (%)**	**Value (US $ Mn)**	**Share in Total (%)**
China	0.1	0.0	0.5	0.2	12.4	1.7	22.9	1.3
Thailand	0.8	0.3	0.4	0.2	10.8	1.5	50.1	2.8
Malaysia	2.9	1.1	2.8	1.1	11.5	1.6	11.7	0.7
Indonesia	3.9	1.6	2.7	1.1	5.7	0.8	12.3	0.7
Singapore	7.1	2.8	2.0	0.8	2.8	0.4	4.4	0.3
Vietnam	0.0	0.0	0.1	0.0	0.7	0.1	0.6	0.0
Japan	0.9	0.4	3.8	1.5	7.6	1.1	18.6	1.1
Korea	0.1	0.0	6.6	2.6	7.2	1.0	69.9	4.0
World	251.4	6.5	253.0	8.1	709.9	8.4	1765.5	10.8

Source: Adapted from Sen and Srivastava (2012), Table 7.

Nag (2011) analyzes this potential effect of trade liberalization on India's participation in IPNs in this industry in greater detail. He observed that India's tariffs on imported auto-components decreased from 35 per cent to 10 per cent over 2001-2008, thereby enhancing opportunity for Indian and India-based global auto-manufacturers to source bigger and cheaper components more efficiently. This study employs a survey to argue that while exporting gear boxes is just the beginning of Toyota's strategy to integrate India into its Asian IPNs, there could be possibilities for Toyota and other

global automobile manufacturers to source automotive hardware such as forged parts, metal components and sub-assemblies as well as software from their Indian operations.

The current level of participation of India in Asian IPNs in this industry is thus low, but promising with more Asian MNEs such as Toyota, Hyundai, Suzuki and others expected to utilize India's potential as a global export platform and integrating it strongly into its Asian IPNs. The current global economic slowdown and debt crisis in Europe is likely to have an adverse impact on Indian auto-component suppliers, as Europe and North America together account for over 60 per cent of auto-component exports from India, and a continued weak demand in these markets implies that utilization rates of capacities at Indian suppliers' end will be sub-optimal, affecting profitability[11].

2.2 Policy challenges towards India's participation in Global IPNs

Sen and Srivastava (2011, 2012) propose six key policy recommendations based on the current state of India's participation in IPNs and the associated policy challenges. These include i) stepping up the pace of unilateral trade and investment liberalization and strive towards further reducing trade and investment barriers; ii) reducing transaction costs of cross-border trade[12]; iii) Improve on the current state of physical and institutional infrastructure for doing business that supports development of IPNs, such as starting and closing a business, dealing with construction permits, paying taxes, trading across borders and enforcing contracts ; iv) develop an appropriate exit policy for labour in manufacturing sector and address current rigidities to make it more competitive vis-à-vis

[11] See Ghosh et.al (2010)

[12] Indeed, when benchmarked against developing countries in Asia that are already well connected with global IPNs, India's overall enabling trade index in 2012 that measures factors, policies and services that facilitate the trade in goods across borders and to destination deteriorated by 16 places in the ranking to be ranked 100th, which was way below that of only better than the Philippines, and lagging behind China and most of the ASEAN economies in aspects of market access, border administration, transport and communications infrastructure and the business environment (The World Bank, 2012). In contrast, Malaysia, Thailand and Indonesia have significantly improved upon their rankings compared to 2010.

South-East and East Asian countries; v) Implementing comprehensive-broad based RTAs covering services, investments, movement of labour and allow them to play a supportive role with ongoing unilateral liberalization and vi) Bring about implementation integrity and effective utilization of RTAs involving India and member countries to ensure that PTA's are implemented with requisite professionalism.

It is thus suggested by the above analysis that merely an RTA would not automatically facilitate in plugging India into Asian IPNs unless these RTAs involve deeper tariff liberalization, complemented with unilateral trade facilitation measures, that would ultimately reduce all the three (network set-up, service link and production) costs[13] involved in attracting MNCs to set up their IPN within India. The policy challenges also suggests that improving productivity growth in manufacturing would be also essential to be competitive in the participation of Asian IPNs. The extent of the economy wide impact on output, trade and welfare due to an RTA, as well as that involving a productivity improvement and trade costs reduction, is thus essential to ascertain, for which an applied general equilibrium (AGE) analysis through the GTAP model needs to be undertaken next.

3. Modelling framework and methodology

3.1 The GTAP model

Since Sen and Srivastava (2011, 2012) and Nag (2011) suggest that auto-parts industry has the strongest potential in the Indian economy to attract IPNs, the AGE analysis and the policy simulation scenarios are specifically focused on this industry. The

[13] See Kimura (2007, 2008) on the details of these costs of setting up IPNs in the Asian context.

standard GTAP model[14] described in Hertel (1997) with the recently updated GTAP 8 database for 2004 is utilized for this analysis.

The simulation involves a 19x7 regional and sectoral aggregation from the original GTAP 8 database based on 57 sectors and 129 regions. The regional aggregation consists of the top 10 auto-parts export destinations of India and its major RTA partners viz. China, Hong Kong, Taiwan, Indonesia, Japan, Korea, Thailand, Malaysia, Singapore, Vietnam, Bangladesh, Sri Lanka, UAE as well as MERCOSUR, NAFTA, EU, ROW and Other LDCs (for which India already has eliminated tariffs on auto-parts) as a regional grouping. The sectoral aggregation separates the Automobiles sector (corresponding to mvh code in GTAP), and aggregates the others into Raw materials for auto, Energy, Services, Other Manufacturing, Transport equipment, and Agri-Forestry & fishing. The standard GTAP closure is slightly altered to reflect the assumptions of unemployment for skilled and unskilled labour in all countries and fixing trade balances for all regions except EU, NAFTA and Japan.

3.2 Tariff simulation design

Since the simulations are expected to analyze an economy wide impact of tariff liberalization in auto-parts, the tariff simulation shocks are set to eliminate tariffs on auto-parts sector (all 6 digit HS codes under 8708) to zero using the tariff simulation rules in TASTE software developed by Horridge and Laborde (2008). Since TASTE corresponds to Macmap (2004) data, we utilize GTAP 8 database for 2004 instead of 2007 for consistency. The base simulation in this study therefore assumes that tariffs on imports of all auto-parts have been eliminated to zero for India and all its RTA partners in East Asia.

[14] For details on the structure of GTAP and a full graphical exposition of the multi-region GTAP model, see Hertel (1997) and Brockmeier (2001)

It is notable that with the exception of Hong Kong and Taiwan, India has already entered into an RTA with all other East Asian regions utilized in this regional aggregation, through Asia-Pacific Trade Agreement (APTA) involving China and Korea in 2001 , through ASEAN-India FTA involving ASEAN-5 countries (Indonesia, Malaysia, Singapore, Philippines and Thailand[15]), in 2011, and India-Japan FTA in 2011.

4. Policy scenarios and details of the simulations

4.1 RTA in auto-parts in East Asia (Scenario 1)

Under the first simulation (Scenario 1), we simulate an RTA removing tariffs on imports of auto-parts only from China, Hong Kong, Indonesia, Japan, Korea, Malaysia, Singapore, Taiwan, Thailand and Vietnam into India, and vice-versa. Table 2 summarizes these tariff cuts in the disaggregated auto-parts sector at the aggregate Automobile (GTAP mvh) sector level.

It is notable that after this simulated tariff cut, the aggregated final ad-valorem tariff rate post-RTA is higher for Indonesia, Korea, Malaysia and Thailand's imports of automobiles from India compared to post-RTA tariff rates for India's import from these countries. India's exports of auto-parts is virtually unaffected by these tariff cuts for Hong Kong, Singapore and Japan who already had zero ad-valorem tariffs pre-RTA. On the other hand, Vietnam's automobile exports to India becomes duty free while those imported by India from Taiwan also faces a steeply reduced tariff rate in the aggregated sector from 15.1% to 1.6%.

[15] Philippines is not separated in the regional aggregation as it is not among the major destination or sources for auto-parts trade with India.

Table 2

Summary of Tariff cuts simulated at the aggregate (GTAP) sector level

Exporter	Importer	Initial AV% tariff rate	Final AV% tariff rate
China	India	15.56	9.96
Hong Kong	India	36.67	31.59
Taiwan	India	15.14	1.65
Japan	India	24.86	16.75
Korea	India	18.46	5.79
Indonesia	India	17.39	9.85
Malaysia	India	25.22	13.78
Singapore	India	16.21	9.93
Thailand	India	17.34	10.54
Vietnam	India	15.00	0.00
India	China	15.14	6.41
India	Hong Kong	0.00	0.00
India	Taiwan	18.89	1.68
India	Japan	0.00	0.00
India	Korea	8.97	7.17
India	Indonesia	24.07	19.87
India	Malaysia	28.79	19.43
India	Singapore	0.00	0.00
India	Thailand	30.55	15.51
India	Vietnam	22.83	18.90

Source: Authors calculations in GTAP based on disaggregated tariff rule in TASTE

4.2 Productivity Growth in India's auto-parts industry (Scenario 2)

In order to analyze the potential economy wide impact of a productivity growth in auto-parts industry, Scenario 2 uses the Growth accounting framework that decomposes output growth into the growth of various inputs and productivity to estimate TFP growth (TFPG) in this sector. Assuming competitive factor markets, full input utilization and constant returns to scale total factor productivity (TFP) growth can be estimated by first estimating the following equation:

$$\Delta \ln Y_t = \beta_0 + \beta_1 * \Delta \ln K_t + (1 - \beta_1) * \Delta \ln L_t \ldots (1)$$

Where Y_t refers to real income, K_t refers to capital at time t , L_t refers to labour at time t and T is a time trend. Coefficient β_1 estimates the share of capital income, which is then fitted in (1) to obtain TFPG.

The methodology for estimating TFPG in this study uses a similar framework, relying on India's Annual Survey of Industries (ASI) data available from 1998-2009. TFP growth rates are estimated only for the auto-parts sector that corresponds to National Industrial Classification (NIC) code 343 as per NIC 1998 and 2004 classification, and as NIC code 293 as per NIC 2008 classification[16]. The variables used for estimation of TFP in this industry are Value of Output, Fixed Capital, Working Capital and Total Persons engaged in this industry. Total capital is calculated as the sum of fixed and working capital, while Total persons engaged measure the labour stock in this industry. Capital and output are converted to real values using sub-sectoral Wholesale Price Index (1993-

[16] ASI identifies this sub-sector as including Manufacture of parts and accessories for motor vehicles and their engines [brakes,gear boxes, axles, road wheels, suspension shock absorbers, radiators, silencers, exhaust pipes, clutches, steering wheels, steering columns and steering boxes and other parts and accessories n.e.c.]

94=100) for the sub-group Motor Vehicles, Motorcycles, Scooters, Bicycles & Parts as estimated by RBI (2012).

The average TFP growth rate over 1999-2009 in this sector using the translog Index[17] was estimated at 1.34%. This is comparable to 1.84% TFPG estimated by Badri Narayanan and Vashisht (2008) over 1991-92 to 2005-06 period for India's manufacture of two/three wheelers and their accessories, and not for parts and accessories only.

The variable aoall (automobiles, India) is thus shocked in the GTAP model by 1.3% in Scenario 2 in addition to an existing RTA in scenario 1.

4.3 Trade cost reduction (Scenario 3)

We use trade cost estimates provided by Duval and Utoktham (2011) and made available by UNESCAP[18]. Following Anderson and van Wincoop (2004), we utilize a shock to comprehensive trade costs excluding tariff ("ntctc_sa" in the database), which encompasses all additional costs other than tariff costs involved in trading goods bilaterally rather than domestically. This measure captures the trade facilitation (customs procedures) related part of trade costs.

In the GTAP model, we shock the variable ams that has also been suggested as one of the appropriate variables to shock in previous studies on trade facilitation impacts such as Andriamananjara, Ferrantino, and Tsigas (2003), Hertel, Walmsley and Itakura (2001) and Fugazza and Maur (2006).

From UNESCAP trade cost database, we observe that nctc_sa estimate for China into India for manufacturing goods reduced from 1.92 to 1.83 over 2008-2009, implying

[17] Total Factor Productivity Growth, as measured by translog Index is defined as
$\Delta \ln TFP = \Delta \ln Q - \Sigma (Sit + Sit\text{-}1)/2 * \Delta \ln Xi$
Where $\Delta \ln TFP$ shows the growth rate of TFP, $\Delta \ln Q$ denotes changes in gross output of the industry, Si denotes income share of the ith input in the industry and Xi stands for the ith input used.
[18] See http://www.unescap.org/tid/artnet/trade-costs.asp for data on bilateral trade costs.

that in ad-valorem equivalent terms there has been a 9% annual reduction in trade costs (related to trade facilitation) between the two countries in manufacturing sector trade over the year. To make it a more realistic trade costs shock for India's trade with other Asian countries, we shock ams (automobiles, REG, India) for all manufacturing sectors in the model by 4.5%, on top of scenarios 1 and 2.

For each of the above three scenarios, we analyze impacts on output, trade prices and overall welfare (in EV terms as measured by GTAP) for the aggregated automobiles sector (corresponding to GTAP code mvh) in India. This is an important limitation of the study as disaggregated sectoral macroeconomic data on auto-parts is yet unavailable in the GTAP database.

A priori, we expect the following economy wide impacts as a result of these simulations:

i) Tariff cuts in auto-parts in India and RTA partners in East Asia should boost bilateral exports from India in the aggregated automobiles sector, as well as expand import demand in India from these countries from all agents, improve allocative efficiency and enhance welfare compared to a non-RTA situation.

ii) Productivity improvement along with an RTA in India's auto-parts sector should expand its domestic output, reduce prices and increase import demand in the aggregated sector from its trading partners compared to only having an RTA in this sector.

iii) Trade cost reductions should further expand trade volumes (both exports from and imports to India) in this sector, and contribute significantly to improvement in welfare compared to having only an RTA with or without productivity improvement.

5. Results and related policy implications

5.1 Output and Prices

The impact of the three policy scenarios on Industry output of automobile sector across all regions is reported in Table 3. It is clearly observed that for India, domestic output of automobiles reduces due to an RTA only, but increases negligibly to 0.04% due to productivity improvements. However trade cost reductions accompanying the RTA and productivity shock are more successful in more than tripling this increase to 0.13%.

Decomposing and evaluation of the industry demand equations in GTAP reveal that only 11% of domestic production of automobiles in India is exported, so share of domestic demand is very large, hence a significant impact is expected on domestic demand for automobiles due to RTA in auto-parts, productivity shocks and trade costs reduction.

When there's an RTA only in auto-parts, decline in domestic demand by -1.73% outweighs expansion in export demand 0.27%, driven by strong decline in industry demand for domestic intermediate inputs, which is substituted by a strong expansion in demand for imported intermediate inputs, there is similar trend observed for private consumption demand towards demanding more imports. The reduction in supply price of automobiles is only 0.09%.

Table 3

Changes in Industry Output of automobiles sector (qo) (%) by regions

	RTA only (1)	RTA with Productivity shock (2)	RTA with productivity shock and trade cost reductions (3)
China	0.00	-0.01	-0.01
HongKong	0.00	0.00	0
MERCOSUR	-0.01	-0.02	-0.02
EU_25	-0.01	-0.03	-0.03
India	-1.46	0.04	0.13
Japan	0.04	0.01	0.02
RestofWorld	-0.01	-0.03	-0.03
Bangladesh	-0.02	-0.31	-0.43
SriLanka	-0.04	-0.48	-0.59
Korea	0.24	0.21	0.22
Taiwan	0.06	0.04	0.05
Indonesia	0.02	0.00	0.01
Malaysia	0.09	0.08	0.09
Singapore	0.29	0.10	0.12
Thailand	0.11	0.09	0.12
Vietnam	0.02	0.01	0.03
UAE	-0.02	-0.05	-0.26
NAFTA	0.00	-0.01	-0.01
Otldczero	-0.02	-0.18	-0.21

Source: Authors calculations in GTAP based on policy simulations

In contrast, when there's an RTA with productivity shock, the decline due to domestic demand is lesser (-1.11%) but expansion in export demand (1.15%) is greater, driven by a very strong substitution effect (almost 6 times larger than RTA only scenario) towards demand for imported intermediate inputs by firms. For private consumption

demand while there's also strong substitution effect towards demanding more imports, there is a small expansion in their domestic demand (qp) due to decline in domestic household prices as a result of improved productivity, that reduces primary input demand by 1.25%. The reduction in supply price of automobiles is now 1.47%, indicating improved competitiveness.

When there's an additional reduction of trade costs in scenario 3, the decline due to domestic demand is greater than scenario 2 (-1.64%) but expansion in export demand (1.77%) is greatest, driven by a very strong substitution effect (almost 2 times larger than scenario 2) towards demand for imported intermediate inputs by firms, there is similar trend observed for private consumption demand towards demanding more imports, improved productivity with trade costs reduces primary input demand (qva) by 1.16%, and also in other manufacturing sectors. The reduction in supply price of automobiles is in this case is 2.38%, indicating further improvements in export competitiveness.

5.2 Trade Patterns

5.2.1 Exports

The impact of the three policy scenarios on aggregate exports of the automobile sector across all regions is reported in Table 4.

Table 4

Region-wise changes in Aggregate exports of automobiles sector (qxw) (%)

	RTA only	RTA with Productivity shock	RTA with productivity shock and trade cost reductions
China	0.02	-0.01	-0.02
HongKong	0.01	-0.02	-0.01
MERCOSUR	-0.03	-0.05	-0.04
EU_25	-0.01	-0.04	-0.04

India	2.43	10.21	15.67
Japan	0.06	0.03	0.04
RestofWorld	-0.03	-0.07	-0.08
Bangladesh	-0.02	-0.07	-0.01
SriLanka	-0.22	0.18	0.74
Korea	0.44	0.39	0.4
Taiwan	0.18	0.15	0.16
Indonesia	0.12	0.04	0.08
Malaysia	0.48	0.43	0.49
Singapore	0.31	0.11	0.14
Thailand	0.35	0.28	0.36
Vietnam	0.2	0.15	0.16
UAE	-0.04	-0.06	-0.34
NAFTA	-0.01	-0.02	-0.02
Otldczero	-0.09	-0.15	-0.1

Source: Authors calculations in GTAP based on policy simulations

It is observed that with an RTA only in auto-parts, India's global exports of automobiles (including auto-parts) are expected to increase by only 2.43%. However, with improved productivity and trade costs reduction, India's exports in this sector is estimated to expand globally by 15%, compared to only 10.2 % from an RTA with productivity improvement in the industry, but no trade costs reduction.

The impact of the three policy scenarios on India's bilateral exports of automobile sector to all regions is reported in Table 5.

Table 5

Region-wise Changes in Bilateral exports of India's automobiles sector (qxs) (%)

	RTA only	RTA with Productivity shock	RTA with productivity shock and trade cost reductions
China	56.18	68.18	76.6

HongKong	0.46	8.24	13.69
MERCOSUR	0.45	8.2	13.62
EU_25	0.46	8.3	13.80
Japan	0.47	8.22	13.64
RestofWorld	0.46	8.18	13.61
Bangladesh	0.4	6.97	11.54
SriLanka	0.33	5.66	9.47
Korea	10.46	19.02	25.07
Taiwan	141.02	159.56	172.57
Indonesia	21.82	31.21	37.8
Malaysia	52.89	64.43	72.56
Singapore	0.46	8.06	13.42
Thailand	98.91	114.25	125.1
Vietnam	20.5	29.65	36.07
UAE	0.45	8.06	13.46
NAFTA	0.46	8.24	13.69
Otldczero	0.42	7.63	12.71

Source: Authors calculations in GTAP based on policy simulations

It is observed that India's bilateral exports in the automobile sector expands most significantly to all regions due to improvements in productivity and trade cost reductions as expected.

Decomposing and evaluation of the export demand equations in GTAP reveal that India is a small player in the world market in this sector. However, with an RTA only in auto-parts, expansion in export demand from India is driven by a strong positive substitution effect from all RTA partners which outweighs the expansion effect; this is so as tariff elimination in auto-parts from India lowers market prices (pms) in China by 7.6%, in Taiwan by 14.5%, in Thailand by 11.6% and in Malaysia by 7.3% (Table 6), among others, while its market price of composite imports (pim) falls by nearly 5%.

Bangladesh and Sri Lanka (which are non-members) do not experience a significant decline in their market prices, but they become cheaper with scenarios 2 and 3.

In contrast, in Scenario 2 expansion in export demand from India is driven almost entirely by an even stronger positive substitution effect from all RTA partners and regions; this is so as tariff elimination in auto-parts from India lowers market prices even more (pms) in China by 8.8%, in Taiwan by 15.6% , in Thailand by 12.7% and in Malaysia by 8.5% (Table 6), and also in other regions due to productivity improvements. This effect is even more stronger in Scenario 3 of an RTA with productivity shock and trade cost reductions in manufacturing, where tariff elimination in auto-parts lowers market prices further than scenario 2 (pms) in China by 9.6%, in Taiwan by 16.4% , in Thailand by 13.5% and in Malaysia by 9.3%, and an average of 2.2% in all other regions, while its market price of composite imports (pim) fell by nearly 9%.

Table 6

Region-wise Changes in domestic price of automobiles sector (pms) (%)

	Prices into India	Prices from India (1)	Prices from India (2)	Prices from India (3)
China	-4.84	-7.65	-8.87	-9.66
HongKong	-3.72	-0.08	-1.40	-2.27
MERCOSUR	0.00	-0.08	-1.40	-2.26
EU_25	0.00	-0.08	-1.42	-2.29
Japan	-6.49	-0.08	-1.40	-2.26
RestofWorld	0.00	-0.08	-1.40	-2.26
Bangladesh	0.00	-0.08	-1.39	-2.25
SriLanka	-0.01	-0.08	-1.41	-2.27
Korea	-10.69	-1.74	-3.05	-3.90
Taiwan	-11.71	-14.54	-15.67	-16.40

Indonesia	-6.42	-3.47	-4.75	-5.58
Malaysia	-9.15	-7.34	-8.55	-9.34
Singapore	-5.41	-0.08	-1.38	-2.23
Thailand	-5.81	-11.60	-12.77	-13.54
Vietnam	-13.04	-3.28	-4.54	-5.36
UAE	0.00	-0.08	-1.39	-2.25
NAFTA	0.00	-0.08	-1.41	-2.27
Otldczero	0.00	-0.08	-1.40	-2.25

Source: Authors calculations in GTAP based on policy simulations

5.2.1 Imports

Since some of India's trading partners reduce tariffs due to the RTA (Table 1), it is also important to analyze the import demand changes due to these three policy scenarios. Table 7 reports the changes in Import demanded at market price of automobiles sector by regions in this aggregated model.

Table 7

Changes in Import demanded at market price of automobiles sector by regions (qim) (%)

	RTA only	RTA with Productivity shock	RTA with productivity shock and trade cost reductions
China	0.01	0.02	0.02
HongKong	0.00	0.00	0.01
MERCOSUR	0.00	0.00	0.00
EU_25	0.00	0.00	0.00
India	12.47	8.93	19.36
Japan	0.02	0.02	0.03
RestofWorld	0.00	0.01	0.02
Bangladesh	0.00	0.06	0.12

SriLanka	0.01	0.23	0.57
Korea	0.20	0.20	0.25
Taiwan	0.05	0.04	0.05
Indonesia	0.01	0.02	0.03
Malaysia	0.06	0.07	0.10
Singapore	0.02	0.01	0.05
Thailand	0.14	0.12	0.16
Vietnam	0.00	0.00	0.02
UAE	0.00	0.01	0.09
NAFTA	0.00	0.00	0.01
Otldczero	0.00	0.07	0.16

Source: Authors calculations in GTAP based on policy simulations

It is observed that import demand of automobiles from India expands significantly to 12.5% due to an RTA only, but in presence of a productivity shock and trade cost reduction, this is estimated to be 19.4%.

Analyzing trends in Region-wise Changes in Bilateral exports of All regions automobiles to India in Table 8, we observe that Bilateral exports to India in the automobile sector expands significantly to all RTA regions, and declines in non-RTA regions. Comparing bilateral export and import changes in Tables 4 and 7, except for Vietnam, Singapore, Korea and Japan, India's exports are found to expand more than its imports, indicating that these policies could potentially improve India's export competitiveness in this sector, thereby making it an attractive candidate for an IPN.

Table 8

Region-wise Changes in Bilateral exports of All regions automobiles to India (qxs)

(%)

	RTA only	RTA with Productivity shock	RTA with productivity shock and trade cost reductions
China	12.32	8.78	14.05
HongKong	5.17	1.85	6.79
MERCOSUR	-14.93	-17.62	-13.61
EU_25	-14.94	-17.62	-13.61
Japan	23.85	19.95	25.78
RestofWorld	-14.94	-17.62	-13.63
Bangladesh	-14.94	-17.63	-13.57
SriLanka	-14.91	-17.2	-12.75
Korea	60.17	55.13	62.61
Taiwan	70.91	65.52	73.57
Indonesia	23.36	19.46	25.26
Malaysia	45.59	41.03	47.89
Singapore	16.13	12.47	17.89
Thailand	18.94	15.21	20.82
Vietnam	86.07	80.21	88.98
UAE	-14.93	-17.6	-13.83
NAFTA	-14.94	-17.62	-13.61
Otldczero	-14.93	-17.58	-13.51

Source: Authors calculations in GTAP based on policy simulations

What are the sources of import expansion? Evaluating and decomposing the import demand equations in GTAP, we observe that with an RTA only in auto-parts, export demand into India is driven by expansion effect from China, HK, Japan, Indonesia, Singapore, Malaysia and Thailand among RTA partners as tariff elimination in

auto-parts into India lowers market prices (pms) most from these countries. In contrast, substitution effect outweighs the expansion effect for Korea, Taiwan, Malaysia and Vietnam.

With an RTA with productivity improvement, as well as trade cost reductions in manufacturing, similar trends are observed with export demand into India driven by a stronger expansion effect than scenario from China, HK, Indonesia, Japan, Singapore, and Thailand among RTA partners.

It is notable that all non RTA members experience decline in their exports to India. Due to the relevant price linkages in GTAP, a tariff reduction shock (tms), affects domestic market prices (pms) of automobiles from India to its trading partners as its supply price (ps) changes, and in India this price decline of 2.38% under Scenario 3 is more than the productivity shock of 1.3%, so trade costs reductions on top of an RTA with productivity improvement further improves competitiveness of India's exports not just to RTA partners, but globally.

There is thus an evidence of a large substitution towards cheaper automobile imports from India (most of which could be auto-parts as a result of the simulations), thereby increasing intra-industry trade in this sector with East Asian countries as a result of an RTA, as well as productivity improvement and trade cost reductions.

5.3 Welfare Impact

The changes in overall welfare and the source of those welfare changes are analyzed through the welcome decomposition analysis described by Huff and Hertel (2000) and in Hanslow (2000). The region wise changes in welfare are measured in money metric terms of changes in Equivalent Variation (EV) in the post shock compared

to a pre-shock period. Table 9 presents the results of these welfare changes from the three policy scenarios.

Table 9

Changes in Region –wise Welfare (US $ million)

	RTA only	RTA with Productivity shock	RTA with productivity shock and trade cost reductions
China	-7.27	-6.66	100.57
HongKong	-1.03	-0.53	17.15
MERCOSUR	-2	-3.50	20.11
EU_25	-31.75	-54.23	455.36
India	43.27	429.63	6280.06
Japan	57.42	25.75	60.7
RestofWorld	-0.09	26.06	583.02
Bangladesh	0.67	0.68	18.21
SriLanka	0.55	2.22	25.66
Korea	61.19	54.25	129.73
Taiwan	1.4	2.03	17.63
Indonesia	1.11	1.21	23.02
Malaysia	4.42	5.78	30.29
Singapore	0.4	1.52	52.93
Thailand	4.08	3.61	19.23
Vietnam	-0.48	-0.37	5.18
UAE	0.57	1.58	118.84
NAFTA	-12.82	-27.63	414.36
Otldczero	0.49	2.56	28.44

Source: Authors calculations in GTAP based on policy simulations

It is observed that compared to scenario 1 wherein India gains an additional welfare of US $ 43.27 million from an RTA in auto-parts only, the welfare gains are 10 times higher with an RTA and a productivity improvement ($ 429.63 million), and these

gains are significantly increased to US $ 6.3 billion with a reduction in manufacturing trade costs in the automobile sector along with an RTA and productivity shock. It is is also notable that in scenario 3, not only India, but all regions positively gain in welfare their changes. This suggests that while India gains most from improving productivity and reducing trade costs apart from zero-tariff RTA in auto-parts, but its trading partners globally also benefit from these policy changes, compared to an RTA only.

Analyzing the sources of these significant welfare improvements for India, it is observed that Allocative efficiency of resources (due to changes in import taxes) – contributes to US $ 1.2 billion improvement in welfare in scenario 3, compared to US $ 92 million in Scenario 1 and US $ 116.2 million in Scenario 2 and mainly due to input and trade tax changes (which increases imports from RTA partners esp. Japan and Korea, as well as Thailand and Malaysia, reduces imports from non-RTA members and expands exports to all regions, but more to EU and NAFTA.

The contribution from Technical efficiency (due to productivity shock and trade cost improvements) is worth US $ 3.7 billion in scenario 3, zero in scenario 1, and US $ 226 million in scenario 2. Finally, Terms of Trade effects (due to export and import price changes and resultant impact on producer and consumer demand) is observed to contributes US $ - 0.7 billion (contribution from automobiles is only - US $ 58 million) in scenario 3, compared to only US $ 27.9 million in scenario 1 and US$ 34 million in scenario 2, as export prices falls more significantly in other manufacturing sectors than automobiles in scenario 3, exports prices of india's automobiles decline by 35.4% in scenario 2, and by nearly 58.0% in scenario 3, compared to only 1.94% in an RTA only in auto-parts.

The above results, albeit based on shocking the aggregated automobile sector, provides important policy implications. First, an East Asian RTA involving auto-parts trade with India, involving tariff reductions only would not have a very significant impact of plugging Indian into Asian IPNs in this sector, although exports to Asian IPN countries might increase to some extent and there will be positive welfare gains. Second, the analysis clearly implies that improving labour productivity in the Indian automobile sector, by the way of removing labour market rigidities along with an RTA would improve its export competitiveness of the automobile sector and make it more attractive as an IPN location by way of reduction of production costs. However, India can best plug into Asian and global IPNs in this sector by reducing border trade costs as this would not only significantly improve its export competitiveness and expand welfare gains for India, but also globally benefit all of its trading partners, as network and service link costs for setting up an IPN in India gets drastically reduced due to these policies.

6. Concluding remarks

This paper attempts to undertake an AGE analysis using the GTAP model based on GTAP8 database for 2004 data, incorporating tariff shocks based on the disaggregated auto-parts sector using TASTE software. Although data limitations force to use the aggregate data for the policy simulations, there is evidence confirming Sen and Srivastava (2011, 2012) argument that India can more successfully be a part of IPNs in Asia not just by RTAs alone. Although there is evidence that there's an export expansion and welfare improvement from better resource allocation through an RTA involving zero tariffs on auto-parts only, the real significant gains for India and its trading partners would accrue if there are reductions in trade costs accompanying technological

improvements in the automobile sector in India, and this should not only reduce border trade costs, but also network costs set up for an IPN.

The above results are subject to data limitations and assumptions of production and consumption structure under the standard GTAP model. However, future research is expected to utilize trade and protection data for 2007 based on the updated TASTE software for GTAP 8 as and when it is available. Further, in order to mitigate the possible "false competition" overestimating the substitution effect between regional suppliers in the GE model identified by Narayanan et.al (2010), efforts will need to be made to incorporate it within the standard modelling framework, by comparing the results with a nested Partial equilibrium (PE)-GE framework as attempted in their study.

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