Can India connect with Asian International Production Networks through RTAs?

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Abstract

The debate on 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 has not been addressed adequately in the existing literature. Except for Narayanan et.al (2010), literature has not delved into the important aspect of linking disaggregated trade data with trade policy analysis in a general equilibrium framework, which has the added value of providing an economy-wide perspective of impact of trade policy instruments such as a trade agreement.

This is one of the first attempts at analyzing the economy-wide impact of India in connecting it with Asian IPNs in an applied general equilibrium framework. This is imperative with Indian economy getting increasingly integrated with rest of the world through calibrated globalization over the past two decades and with creating a web of such trade agreements. The Indian auto-parts industry is chosen for investigation since the existing literature identifies that the impact of deep integration is higher for trade in automobile parts and information & technology products, with a greater potential to integrate into existing Asian IPNs.

The paper incorporates disaggregated tariff shocks on auto-parts into the aggregate GTAP automobiles sector. The simulations involve a 19x7 regional and sectoral aggregation from the original GTAP 8 database, based on a multi-regional Applied General Equilibrium (AGE) model *which captures world production, taxes, prices and trade in 57 different industries of 129 regions. The regions in the database are disaggregated into India and its major export and import destinations (including RTA partners) over 2004-2009, while the sectoral aggregation involves a disaggregation of the manufacturing sector, and more specifically, the motor vehicles and parts sector. Additional scenarios of productivity improvement, derived from econometric analysis, along with reduction in trade costs along with the RTA, are also explored.*

The results suggest that only tariff reduction measures through RTAs can be partially successful in connecting India into IPNs in Asia with very modest welfare gains. However, complementing RTAs with accompanying unilateral reforms targeted at productivity improvement and reducing cross-border trade costs for the IPN promising sectors (such as automobiles) would yield far greater welfare gains and improvement in its global export competitiveness. Overall, a key finding is that such a policy mix would benefits not just RTA partners, but all of India's trading partners globally as this should not only reduce border trade costs, but also network set up costs for an IPN.

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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] providing opportunities for participating countries to gain access across international markets and benefit from technology transfer through Foreign Direct Investment (FDI)[2]. IPNs have allowed larger spin-offs among number of countries with different income levels in Asia. Multinationals primarily 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 have been the primary drivers of these IPNs. Their creation has contributed to an increasing share of intra-industry trade (IIT) in machinery parts and components involving these countries as identified in the literature[3]. This is reflected in an ever increasing involvement of foreign-owned affiliates in different locations along the producer-driven chains' wherein the finished goods tend to be mainly supplied by multinationals in core countries (Gereffi, 2001).

In contrast to the above experiences in East Asia, India has been left out of these Asian IPNs in the 1980s and early 1990s, owing to its late adoption of export-oriented industrialization and concomitant adherence towards unilateral reduction of trade barriers. According to Veeramani

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[1] See Rajan, 2003, Hummels *et al*. (2001), Yi (2003), Krugman et.al (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.

(2009), India's IIT during this period was being negatively influenced by market-seeking nature of its inward FDI in the domestic industries, which was not conducive to IPN development.

India's "calibrated" globalization efforts undertaking wide-ranging trade and investment liberalization measures over the past two decades have deepened its integration with the rest of the world. Therefore, the possibility of India successfully connecting with Global and Asian IPNs in the near future has been an important subject of recent research. Such possibilities are being analyzed in the wake of India's look-east policy and its integration with South-East and East Asia through a web of bilateral and regional trade agreements (RTAs).

As of June 2011, India implemented 12 RTAs and is currently negotiating or proposing many more of such agreements (UNESCAP, 2011a and b).[1] India's RTA activity is therefore now comparable with that of the other major Asian countries that are strongholds of IPNs, viz. China and Japan. Asia (including ASEAN) was India's largest export destination accounting for 55 % of total exports between April 2009 and September 2010, compared to just 40% in 2001-02[4]. Further, India is part of the ongoing negotiations of Regional Comprehensive Economic Partnership (RCEP) agreement since November 2012 that is aimed to evolve into a regional free trade agreement encompassing the ASEAN+6 member countries, that would include India, China, Japan, Korea, Australia, New Zealand and the 10 ASEAN members. Notably, India already has a working RTA in force with ASEAN countries that has recently been extended to include trade in services and investments effective from December 2013.

Recent literature has argued that RTAs can facilitate creation and development of international production networks (IPNs) among member countries, and this depends on the comprehensive coverage of an RTA and the extent to which policies are designed to deepen regional integration,

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[4] See Rajan and Gopalan, (2011)

beyond simple reduction in tariffs and non-tariff barriers (Orefice and Rocha, 2011 and Hew et. al., 2009).

Given the above background, this paper attempts to specifically analyze India's ability to connect and contribute to IPNs in Asia through Regional Trading Agreements (RTAs). The auto-parts industry is selected for this analysis based on two criteria: First, this industry has been identified in the existing literature as one of the high-growth and rapidly liberalizing sectors for India's manufacturing sector. Second, this industry has also been tapped by multinationals as a prospective player in Asian automobile IPNs. (See Narayanan and Vashisht, 2008; Sen and Srivastava, (2011, 2012), Srivastava and Sen (2011); Nag, 2011).

While the above studies are only the few that have attempted to analyze India's ability to connect with Asian IPNs, they have not accounted for the possible welfare impact on the Indian economy if it were to enter into an RTA in this industry with East Asia, an important aspect that is often analyzed by policymakers before entering into RTA negotiations. The effect of such an RTA on the welfare of India's trading partners in East Asia has also not been explored[5]. Further, the existing literature does not attempt to quantify the changes in welfare due to trade costs reduction and productivity improvement on India's export potential in this industry, which holds important implications for this industry in India to be connected to Asian IPNs[6].

This paper contributes to the existing literature by analysing the impact of tariff reduction in auto-parts for India's RTAs involving East Asia in an applied general equilibrium (AGE) framework utilizing the GTAP 8 database based on 2004 data. The paper undertakes a base policy simulation of an impact of tariff reduction in auto-parts for India's currently implemented FTAs with ASEAN,

[5] There have been studies involving ASEAN and India at an aggregate level (Pal and Dasgupta (2009), Nag and Sikdar (2011), but sectoral disaggregated analysis has not been undertaken so far.

[6] Kimura (2007, 2009) and related literature on IPN development note that both productivity improvement and trade cost reductions directly impact on lowering the costs of entering into an IPN.

Japan, Korea and EU. The uniqueness of this paper lies in extending the base simulation scenarios to the additional scenarios of productivity improvement estimated econometrically and reduction in trade costs, proxying trade facilitation, as estimated by the state-of-the-art gravity-based literature, which has never been attempted before in the existing literature. 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 modelled in this database, deriving useful policy implications for India and its trading partners.

The remainder of this paper is organized as follows. Section 2 presents the key trends in India's automobile industry and trade in the auto-parts sector over the past decade. Section 3 reviews the literature on IPNs and how RTAs may facilitate their development. It also reviews the current state of India's participation in Asian IPNs. Section 4 analyzes the modeling framework and methodology. Section 5 identifies the policy scenarios and details of the simulations. Section 6 analyzes the results and related policy implications, while the final section (Section 7) concludes the paper.

2. Trends in India's Automobile Industry and Auto-parts trade

Over 2000-2014, 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$ 9.8 billion over April 2000-March 2014, constituting a share of 5 per cent of the total (DIPP, 2014) .However, data is unavailable on the contribution of Multinational Enterprises (MNEs) in this industry by their country of origin[7], 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

[7] 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.

organized sector in this industry contributed to 58 per cent of the total production, with large Indian firms[8] 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).

The majority of India's auto-components exports have been destined for UK, USA, Italy, Germany, Mexico, Bangladesh, Sri Lanka and the Middle East countries. This is found to be 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. Table 1 documents the trends in India's automobile P/C exports to major Asian countries involved in an IPN over 1994, 1999, 2004 2008 and 2012. This shows that the share of India's automobile P/C exports to eight major auto-component producers in Asia increased from 6.5% in 1994 to 15.2% in 2012. There was a major expansion in value and share of these auto-parts exports to Republic of Korea, Thailand, China and Japan respectively. The data suggests that while India's exports of automobile P&C products to Asia has increased since the economic reforms, its current scale of participation in Asian IPNs is quite low. Notably, India and Thailand entered into a bilateral trade agreement in 1993 that involved auto-parts, and India's exports of auto-parts to Thailand witnessed the largest expansion in share over 1999-2012.

(Table 1 about here)

[8] 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).

3. Literature Review[9]

According to Kimura (2007), there are three sets of costs that determines the development of a country's participation in Asian IPNs. These costs include a) network set-up costs to develop new production networks; b) service link costs to connect each production block within a network[10] and c) production costs within each production block.

Kimura (2009) further identified four phases of industrialization, based on current participation in production and distribution networks (Figure 1). The first phase essentially includes countries that need to get into the production networks, and which are building a business-friendly investment climate in order to attract new production blocks.

(Figure 1 about here)

Typically, these are low-income developing economies, which face significant policy challenges in attracting efficiency-seeking or export-platform FDI. The second phase requires development of industrial agglomeration to support the existing production blocks. For countries in the second phase, it is important to attract foreign small and medium-sized enterprises (SMEs) that form into industrial clusters of vertical production networks by removing investment bottlenecks and improving service link arrangements. The third and fourth phases comprise countries that are industrialized and whose firms are already internationally competitive and have become multinationals, developing their own production and distribution networks.

Based on the above framework, India's current situation with regards to IPN development would probably be characterized as being in the first phase, with potential to develop its strengths towards entering the second and perhaps the third phase in the near

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

[10] These would involve transaction costs related to transportation, telecom, logistics, distribution and coordination.

future. This would, in turn, depend on the pace and credibility of its policymakers to undertake structural reforms that would improve its infrastructure, reform labour laws and reduce cross-border trade costs.

How would RTAs facilitate IPN development in India? Hew et al. (2009) observe that RTAs involving tariff reductions offer developing countries in Asia the potential to reduce their service link costs to attract new production blocks within the existing network. However, the elimination of behind the border and non-tariff measures involving trade and investment facilitation are absolutely crucial for deepening regional integration that will reduce all three costs of participating in Asian IPNs. This study and earlier analysis of trade policy in Asia by Sally and Sen (2011) emphasize that, in the long run, RTA measures need to be supported by strong domestic reforms in the area of institutional and infrastructure development. This is of significance to policymakers in India, if they utilize RTAs to integrate industries into Asian IPNs. The above suggests that tariff reduction through RTAs is at best the first step towards attracting IPN development, but it can be further strengthened through productivity improvement (involving domestic reforms) and reduction of trade costs (involving reduction and/or elimination of behind the border restrictions on trade flows) through customs harmonization and improved regulation.

By entering into an RTA with Asian IPN members (viz. ASEAN countries, China, Japan and Korea, India should therefore get connected to the Asian IPNs through expansion of intra-industry trade in parts and components (both on the export and import side) which will create opportunities for producer driven fragmentation. This will lower India’s service-link costs to connect it to a production block within the Asian IPN network. The relative abundance of unskilled labour in India when compared to more developed Asian IPN member countries should also prove to be a source of comparative advantage, thereby potentially lowering the production costs of entry into an IPN.

The empirical analysis for estimating production fragmentation and hence participation in IPNs, necessitates 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. Adopting this framework, Sen and Srivastava (2012) analyzed parts and components (P/C) trade for India for the period 1994, 1999-2004 and 2005-2008. The P/C products traded in India's manufacturing sector were identified at the 5-digit level using Standard Industrial Trade Classification (SITC) 7 and 8 industry groups from the UN Comtrade database. This constituted a total of 231 products, with 172 products belonging to SITC 7 and 59 belonging to SITC 8 category of manufactured goods. Since IIT in P/C trade suggests evidence towards existence of producer driven fragmentation and IPN activity, this paper further 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 involves intra-industry trade involving trade in fragmented production chains. Further, to ascertain whether the change in trade volumes in these P/C manufacturing products over the time periods analyzed were more due to intra-industry or inter-industry trade, estimates of marginal IIT for top 20 products involving two-way IIT as suggested by Brülhart (1994) were analyzed. It was 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, suggestive of an emergence of producer driven fragmentation in this product category that involved automobile parts. This study did not go onto analyse whether India's RTAs were likely to have an impact on this emerging producer driver fragmentation in this sector.

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 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. Indo-Thailand FTA is shown to increase the net auto exports of India to Thailand, indicating that trade liberalisation could be a way of ensuring high demand. Narayanan and Vashisht (2008), based on a field survey, found that credit constraints as well as lack of demand stability as the main reasons for slow growth of scale of production.

Nag (2011) noted that while majority of India's auto-exports was not destined for Asia[11], it has been increasingly sourcing a significant amount of auto-components from Asia as a result of its trade liberalization. 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. The survey of automobile firm Toyota (India) suggested that while exporting gear boxes was just the beginning of Toyota's strategy to integrate India into its Asian IPNs, there were 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 albeit low, has been thereby identified

[11] This study observed that bilateral IIT was highest for India's trade in auto-parts with US and Germany, in 2007-08.

to have a promising future 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.

Nag and De (2011) analysed the impact of Rules of Origin (RoO) in RTAs on the development of IPNs. They concluded that simpler RoO work better for parts and components and intra-industry trade in an IPN, even if tariffs may not be lowered significantly in a PTA. Complex RoOs provide increased avenues for corruption, since customs officials can exercise significant discretion in deciding on which tariff or rules to apply to a certain product (Newfarmer, 2005). If the utilization of these restrictive RoO preferences adversely affects any of the three types of costs involved in participation in a production network, India's PTAs could actually end up adversely affecting its prospects for integrating into production networks in the ASEAN region and in East Asia, which has largely been market-driven.

Narayanan et.al (2010) is the only empirical study that specifically analysed the effect of tariff liberalization in the Indian automobile industry using an AGE analysis, comparing it with a nested partial-equilibrium (PE) framework. Though this paper did disaggregate tariff shocks on auto-parts, its objective was merely to illustrate the PE/GE model and not to analyse whether trade in intermediate goods would increase and thereby facilitating IPN connectivity. This study did not consider any further additional policy shocks in the model apart from tariff liberalization.

It is observed from the above state of the theoretical and empirical literature that there has been a lack of studies utilizing an AGE framework to explore i) whether an RTA in the auto-parts industry can expand India's export capabilities in the automobile sector to Asian IPN member countries and beyond creating a global platform for its auto-component exports; ii) whether these exports and India's auto-parts production will be significantly enhanced by a productivity improvement in this sector[12], in addition to an RTA; and iii) as observed by Sen and Srivastava (2012) and Nag (2011), how important is the trade cost as a barrier to export expansion ? Would a possible trade costs reduction (as a result of a trade facilitation agreement) change India's production and trade patterns vis-vis East Asian IPN and other trading partners? All the three scenarios provide important policy implications for India's continuing emphasis on its "Look East" Policy and strengthening its regional integration with East Asian economies.

As per theoretical considerations, the following impacts may be expected as a result of undertaking policy simulations on the above 3 scenarios:

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, and improve allocative efficiency and enhance welfare compared to a non-RTA situation as price distortions due to the tariffs are corrected.

ii) Productivity improvement along with an RTA in India's auto-parts sector should further 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 in manufacturing sector apart from an RTA should improve trade facilitation, resulting in reduced behind the border barriers, and thereby expand bilateral trade volumes (both exports from and imports to India) in the aggregated automobile sector. The removal or reduction of these barriers due to trade costs should contribute significantly to improvement in welfare compared to having only an RTA with or without productivity improvement.

[12] This is expected to an outcome with Government of India approving the national manufacturing policy (NMP), with the aim of increasing the share of manufacturing in gross domestic product (GDP) from the current (2011) share of 16 per cent to 25 per cent by 2025 (Sen and Srivastava, 2012).

4. Modelling Framework and Methodology

4.1 The GTAP model

In order to analyze the impacts on output, trade and welfare due to an RTA in the auto-parts industry involving India and East Asian trading partners, an applied general equilibrium (AGE) analysis is more appropriate. The standard GTAP model, which is a multi-sectoral multi-regional Computable General Equilibrium (CGE) model framework, described in Hertel (1997) with the recently updated GTAP 8 database for 2004 (documented in Narayanan et. al., 2012) is utilized for this purpose.

The standard GTAP model is based on the assumption of perfect competition and constant returns to scale. The trade data in the GTAP database distinguishes between commodities on the basis of their countries of origin and destination, and also on the basis of the agents (intermediate demand, and final demand by household, government and investment) that absorb the commodities in the importing economy, thus allowing for the varying import intensities by different agents within regions and across countries disaggregated in the model. This is the Armington assumption (Armington, 1969) that is incorporated across all variety of CGE models and results of policy experiments are sensitive to both substitution elasticities and trade shares (de Melo and Robinson, 1989). Region-specific trade tax data, import duties export taxes, and transport costs are recorded for each and every trade transaction in this database and the model.

The remaining data in the GTAP database come from input-output tables of each country/region modelled in the database. Domestic agents not only pay import duties, their commodity purchases are also subject to sales taxes. Domestic supply is either sold on the domestic market or exported. In addition to purchasing intermediate inputs, the agents purchase combinations of five primary factors – land, capital, natural resources and skilled and unskilled labour – and pay indirect/production taxes. The ‘regional’ household in this model receives all income from factor sales, and from five different tax instruments[13]. This income is then distributed to the private household, savings and government. A 'global bank' draws together savings by the regional household and the rest of the world (external balance), and disburses those funds to investment by commodity (domestic and imported) [14].

The motivation to choose this methodology and the GTAP model is two-fold. Firstly, we would like to capture the inter-sectoral and inter-regional linkages involved in this industry, given that the Indian auto industry is large and has a global presence. Secondly, a complete econometric analysis involving a time series (such as a gravity equation) is not possible for this issue for several reasons: lack of sufficient time-series data given that IPNs are relatively futuristic in Indian scenario and the deficiencies in partial equilibrium econometric frameworks in capturing the complex relationships that determine the joint impact of productivity, trade costs and RTAs on IPNs. Several comprehensive studies on regional trade agreements have employed the standard GTAP model. Notable examples of such studies include Adams (1998), Ianchovichina, Nicita and Soloaga (2002), Bandara and Yu (2003), Karingi, Perez and Hammouda (2007), Anderson and Valenzuela (2007), Perez and Karingi (2007), Fugazza and Vanzetti (2008), MacDonald and Walmsley (2008), Chong and Hur (2008) and Philippidis and Karaca (2009). More importantly, almost all studies since the late 1990s, including even those employing CGE/PE models other than GTAP, have employed GTAP Data Base for analyzing trade policy impacts across many countries in the world (Hess and von Cramon-Taubadel, 2008). Brown, Kiyota and Stern (2006), for instance, employs Michigan model in conjunction with GTAP Data Base.

[13] These are import and export duties, sales/commodity taxes, production taxes and factor taxes.

[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)

The policy simulations involve a 19x7 regional and sectoral aggregation from the original GTAP 8 database based on 57 sectors and 129 regions[15]. 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, United Arab Emirates (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 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[16].

4.2 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 the auto-parts sector (all 6 digit HS codes under 8708) to zero[17] using the tariff simulation rules in TASTE (Tariff Analysis and Simulation Tool for Economists) software developed by Horridge and Laborde (2008) which reads from the MAcMapsHS6 data on trade and tariffs, produced by International Trade Center (ITC)-Geneva and Centre d'Etudes Prospectives et d'Informations Internationales (CEPII) , Paris. This approach allows an economy-wide analysis of welfare impacts of such an RTA on the service

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[15] For a list of original sectors and regions documented in the GTAP Database, see https://www.gtap.agecon.purdue.edu/databases/regions.asp?Version=8.211 and https://www.gtap.agecon.purdue.edu/databases/v8/v8_sectors.asp

[16] This has been undertaken by earlier studies involving standard GTAP model simulations such as MacDonald and Walmsley (2008).

[17] Note that this implies that only import taxes on automobile parts (and not the entire automobile sector) are set to zero through this software.

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 current version of TASTE corresponds to Bouët et.al (2004) that describes the MacMap HS-6 trade and tariff database and also corresponds to the GTAP 7 database for 2004. We therefore utilize the updated GTAP 8 database for the same year, i.e. 2004 to maintain consistency with TASTE, although 2007 data is also available for simulations in the GTAP 8 database. The base simulation in this paper therefore assumes that tariffs on imports of all auto-parts in 2004 have been reduced to zero for India and all its RTA partners in East Asia. 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, India-Korea Comprehensive Economic Partnership Agreement (CEPA) in 2010, through ASEAN-India FTA involving ASEAN-5 countries (Indonesia, Malaysia, Singapore, Philippines and Thailand[18]), in 2011, and India-Japan FTA in 2011.

5. Policy Scenarios

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 Motor vehicles and parts (*mvh*) sector level presented in GTAP.

(Table 2 about here)

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

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%. Since Table 1 suggests that Korea, Thailand and China are likely to be major destinations for India's auto-parts exports, the tariff cuts of these countries on auto-parts imports from India, which are substantial (See Table 2), are of major significance.

5.2 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. This estimate of TFPG is then shocked in the GTAP model for India's automobile sector. The motivation behind this is to ascertain the possible effects of productivity improvement in the automobile sector as a result of implementation of India's National Manufacturing Plan (NMP) along with the pursuance of its RTAs with East Asia.

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:

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

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 paper 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[19]. 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 (1993-94=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[20] was estimated at 1.34%. This is comparable to 1.84% TFPG estimated by 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* (for automobiles sector in India) in GTAP model, which represents TFPG, is thus shocked by 1.3% in Scenario 2 in addition to an existing RTA in Scenario 1.

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[19] 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.]

[20] Total Factor Productivity Growth, as measured by translog Index is defined as

$\Delta \ln TFP = \Delta \ln Q - \Sigma (S_{it} + S_{it}-1)/2 * \Delta \ln X_i$

Where $\Delta \ln TFP$ shows the growth rate of TFP, $\Delta \ln Q$ denotes changes in gross output of the industry, S_i denotes income share of the $_i$th input in the industry and X_i stands for the ith input used.

5.3 Trade Cost Reduction (Scenario 3)

Trade costs (incorporating both transportation costs and tariff barriers) have often been identified as a barrier towards expansion of India's bilateral trade with Asia and a number of studies including De (2006, 2009a), Sen and Srivastava (2012) as well as Nag (2011) identify them as key barriers towards India's expansion of its global trade potential. Several studies have tried to measure trade costs including Anderson and Van Wincoop (2004) and Novy (2013) in a more recent paper provides a micro-founded measure of bilateral trade costs that can be calculated from observable trade data.

This paper uses trade cost estimates provided by Duval and Utoktham (2011) and made available by UNESCAP[21]. 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. Since tariff reduction is already accounted for in Scenario 1, the trade costs shock added here reflects the effect of India entering into a trade facilitation agreement apart from a tariff reduction in a comprehensive RTA. With the recent WTO ministerial meeting in Bali in December 2013 agreeing on negotiating an Agreement on Trade Facilitation[22] that will aim at reducing the cost of trading by making binding commitments in customs procedures and regulations, this scenario is a very realistic one to model in this paper.

In the GTAP model, we shock the variable *ams* (import-augmented technological change, which captures changes in trade costs specific to a given bilateral trade flow) that has also been suggested

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[21] See http://www.unescap.org/tid/artnet/trade-costs.asp for data on bilateral trade costs.

[22] See http://www.cuts-citee.org/pdf/Unpacking_the_Bali_Package-A_Snapshot_of_the_Bali_Ministerial_Decisions_of_the_WTO_Members.pdf for further details on the Agreement on Trade Facilitation.

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 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. However, this database does not distinguish further the differences that would exist in trade costs across the disaggregated manufacturing sectors. Recent studies on trade costs involving India's trade with Asia suggests that sectoral ad valorem transportation costs for India in 2005 was lower in the automobile and components sector than in other sectors such as food products, electronic integrated circuits, electrical and electronics, office and telecom equipment, textiles and clothing, and paper and pulp (De, 2009a). It was also observed by De (2009b) that the international ad valorem international transportation costs for India's manufacturing sector in 2005 (as a % of its import value from South Asia) was estimated to be 4.2%.This appears to be a more realistic trade costs shock for India's trade with other Asian countries (taking into account possible delays in policy implementation), due to the fact that Auxilliary shipping charges, a key component of trade costs was estimated to be lower in Automobile and components sector compared to other manufacturing sectors and was also lower than India's overall weighted average trade costs in 2005[23]. Therefore we shock *ams* (*automobiles, REG, India*) for all manufacturing sectors in the model by 4.5%, on top of scenarios 1 and 2.

[23] See De (2009a) Tables 4.5 (b)..

For each of the above three scenarios, we analyze impacts on output, trade volumes, prices and overall welfare (in Equivalent Variation (EV) terms as measured by GTAP) for the aggregated automobiles sector (corresponding to GTAP sector *mvh*) in India. This is an important limitation of the paper as disaggregated sectoral production, consumption and input-output data on auto-parts is unavailable in the GTAP database as well as from the other global data sources.

The results reported below are comparative static in nature given the structure of the GTAP model and hence does not capture any potential dynamic effects of these policy shocks.

6. Results and Policy implications

6.1 ***Output and Supply 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 scenario, but increases negligibly to 0.04% due to productivity improvements. However trade cost reductions accompanying the RTA and productivity shock are 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 substantial proportion of the impact of these policy shocks is expected to be on the domestic demand for automobiles due to an 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 by 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, and there is similar trend observed for private consumption demand towards demanding more imports. The reduction in supply price of automobiles is only 0.09%, suggesting that entering into an RTA in auto-parts in the baseline scenario does not improve the competitiveness of India's automobile sector both domestically and globally to a large extent.

In contrast, when there's an RTA with a 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 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 compared to the baseline scenario of only tariff reduction through an RTA.

(Table 3 about here)

When there's an additional reduction of trade costs in scenario 3, the decline due to domestic demand is even greater than scenario 2 (-1.64%) but expansion in export demand (1.77%) is greatest, driven by a very strong substitution effect (almost double than that of 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 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.

6.2 Export Volumes and Prices

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

(Table 4 about here)

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 10.2 % from an RTA with productivity improvement without any accompanying trade costs reduction.

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

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. This provides a strong justification for India to pursue a trade facilitation agreement if it is to improve its global export competitiveness in this industry. Notably, among India's current RTA partners, exports to both Thailand and China (which were major destinations for India's auto-parts exports in East Asia in 2012) shows a substantial expansion. The substantial bilateral export volume for Taiwan suggests that while it is not yet an RTA partner for India, a potential future RTA could be beneficial in making it an important export destination for India's automobiles sector.

(Table 5 about here)

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 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 falls by nearly 5%. 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 due to productivity improvements. This effect is strongest 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, while its market price of composite imports fell by nearly 9%.

6.3 Imports Volume and Prices

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 volume of Import demanded at market price of automobiles sector by regions in this aggregated model.

It is suggested 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%.

(Tables 6 and 7 about here)

Bilateral exports to India in the automobile sector expands significantly to all RTA regions (Table 8), and is observed to decline in non-RTA regions[24]. 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 about here)

[24] *Ibid*.

What are the sources of import expansion? Evaluating and decomposing the import demand equations in GTAP, we find 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 from 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 modelled in this paper experience decline in their exports to India. Due to the relevant price linkages in GTAP, a tariff reduction shock affects domestic market prices of automobiles from India to its trading partners as its supply price changes[25], 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.

6.4 Welfare Impact

[25] See Hertel and Tsigas (1997) for details on these price linkages in the GTAP model.

The changes in overall welfare and the source of those welfare changes are analyzed through the welfare 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 about here)

It is notable 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 expand by nearly 15 times to US $ 6.3 billion with a reduction in manufacturing trade costs (simulating trade facilitation) in the automobile sector along with an RTA and productivity shock. It is also observed 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, 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 provide important policy implications. First, an East Asian RTA involving auto-parts trade with India, involving tariff reductions only would not have a very substantial impact of connecting Indian into Asian IPNs in this sector, even though exports to Asian IPN countries might increase to some extent and there will be positive welfare gains. Second, the analysis points to the evidence that improving productivity in the Indian automobile sector, along with an RTA would improve its export competitiveness and make it more attractive as an IPN location by way of reduction of production costs. Thus, the NMP for India's manufacturing sector, aimed at improving its productivity, should be implemented soon. Finally, the paper provides clear evidence to the fact that reducing border trade costs[26] and enabling trade facilitation between RTA partners would not strengthen its India's global export competitiveness and expand its welfare gains substantially beyond tariff reductions and productivity improvement. The results also suggest that trade facilitation measures by India in its manufacturing sector but also globally benefit all of its trading partners, as network and service link costs for setting up an IPN in India would get

[26] 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 lagging behind China and most of the ASEAN economies in aspects of market access, border administration, transport and communications infrastructure and the business environment (World Economic Forum, 2012). In contrast, Malaysia, Thailand and Indonesia have significantly improved upon their rankings compared to 2010.

drastically reduced due to these policies[27].Thus, India should also seriously consider implementing trade facilitation agreements in its current as well as future RTAs.

7. Concluding Remarks

This paper incorporates disaggregated tariff shocks on auto-parts through TASTE into the aggregate GTAP automobiles sector, being one of the first attempts at analyzing the economy-wide impact of India in connecting it with Asian IPNs in an applied general equilibrium framework. The results suggest that tariff reduction measures through RTAs can only be partially successful in connecting India into IPNs in Asia with very modest welfare gains. Complementing RTAs with accompanying structural reforms targeted at productivity improvement and reducing cross-border trade costs for the IPN promising sectors (such as automobiles) would yield far more substantial welfare gains and improvement in its global export competitiveness. A key finding is that such a policy mix would benefits not just RTA partners, but all of India's trading partners globally.

The above results are subject to data limitations and assumptions of production and consumption structure under the standard GTAP model. The future research would endeavor 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. This can be achieved by comparing the results with a nested Partial equilibrium (PE)-GE framework as attempted in their paper.

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[27] For details on the associated policy challenges and required reforms to improve India's participation in Global and Asian IPNs, see Sen and Srivastava (2011, 2012)

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Table 1

India's Exports of Auto-parts[28] to major countries involved in Asian automobile IPNs, 1994-2012

	1994		**1999**		**2004**		**2008**		**2012**	
	Value (US $ Mn)	**Share in Total (%)**	**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	0.5	0.2	12.4	1.7	22.5	1.4	63.4	1.8
Thailand	0.8	0.3	0.4	0.2	10.8	1.5	47.9	3	207	5.9
Malaysia	2.9	1.1	2.8	1.1	11.5	1.6	11.7	0.7	27.7	0.8
Indonesia	3.9	1.6	2.7	1.1	5.7	0.8	12.3	0.8	113.3	3.2
Singapore	7.1	2.8	2	0.8	2.8	0.4	16.9	1.1	9.7	0.3
Vietnam	0	0	0.1	0	0.7	0.1	0.6	0	1.5	0
Japan	0.9	0.4	3.8	1.5	7.6	1.1	18.5	1.2	84.08	2.4
Korea	0.1	0	6.6	2.6	7.2	1	48.01	3	24.8	0.8
World	251.4	6.5	253	8.1	709.9	8.4	1591.6	11.2	3515.1	15.2

Source: Author's calculations from UN Comtrade database

[28] This corresponds to HS 4digit 8708 (Parts and accessories of the motor vehicles of headings 87.01 to 87.05) in the UN comtrade database..

Table 2

Summary of Ad-Valorem (AV) Tariff cuts simulated at the aggregate GTAP sector level for automobiles sector

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

Source: Authors calculations in GTAP based on disaggregated tariff rule in TASTE; Final tariff rates refers to post-simulation scenario of a zero tariff 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 3

Changes in Industry Output of automobiles sector (%)

	RTA only (S1)	RTA with Productivity shock (S2)	RTA with productivity shock and trade cost reductions (S3)
China	0.00	-0.01	-0.01
Hong Kong	0.00	0.00	0
India	-1.46	0.04	0.13
Japan	0.04	0.01	0.02
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

Source: Authors calculations in GTAP 8 based on policy simulations. S1, S2 and S3 refers to each of the three different scenarios, with S1 being the base scenario of an RTA in auto-parts only.[29]

[29] Results on non-RTA partner countries/ regions modelled are available from the authors on further request.

Table 4

Changes in Volume of Aggregate exports of automobiles sector (%)

	S1	S2	S3
China	0.02	-0.01	-0.02
Hong Kong	0.01	-0.02	-0.01
India	2.43	10.21	15.67
Japan	0.06	0.03	0.04
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

Source: Authors calculations in GTAP based on policy simulations. S1, S2 and S3 refers to each of the three different scenarios, with S1 being the base scenario of an RTA in auto-parts only.[30]

[30] *Ibid.*

Table 5

Changes in Volume of Bilateral exports of India's automobiles sector (%)

	S1	**S2**	**S3**
China	56.18	68.18	76.6
Hong Kong	0.46	8.24	13.69
Japan	0.47	8.22	13.64
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

Source: Authors calculations in GTAP based on policy simulations. S1, S2 and S3 refers to each of the three different scenarios, with S1 being the base scenario of an RTA in auto-parts only. [31]

[31] *Ibid.*

Table 6

Changes in export and import price of automobiles sector (%)

	Prices into India	Prices from India (S1)	Prices from India (S2)	Prices from India (S3)
China	-4.84	-7.65	-8.87	-9.66
Hong Kong	-3.72	-0.08	-1.40	-2.27
MERCOSUR[32]	0.00	-0.08	-1.40	-2.26
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

Source: Authors calculations in GTAP based on policy simulations. S1, S2 and S3 refers to each of the three different scenarios, with S1 being the base scenario of an RTA in auto-parts only.[33]

Table 7

Changes in Volume of Import demanded at market price of automobiles sector (%)

[32] Refers to the South American Common Market whose members are Argentina, Brazil, Uruguay and Paraguay.
[33] *Ibid.*

	S1	S2	S3
China	0.01	0.02	0.02
Hong Kong	0.00	0.00	0.01
India	12.47	8.93	19.36
Japan	0.02	0.02	0.03
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. S1, S2 and S3 refers to each of the three different scenarios, with S1 being the base scenario of an RTA in auto-parts only. [34]

Table 8

Changes in Volume of Bilateral Exports of automobiles to India (%)

	S1	S2	S3

[34] *Ibid.*

China	12.32	8.78	14.05
Hong Kong	5.17	1.85	6.79
Japan	23.85	19.95	25.78
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

Source: Authors calculations in GTAP based on policy simulations. S1, S2 and S3 refers to each of the three different scenarios, with S1 being the base scenario of an RTA in auto-parts only. [35]

Table 9

Changes in Aggregate Welfare (US $ million)

	RTA only (S1)	**RTA with Productivity shock**	**RTA with productivity shock**

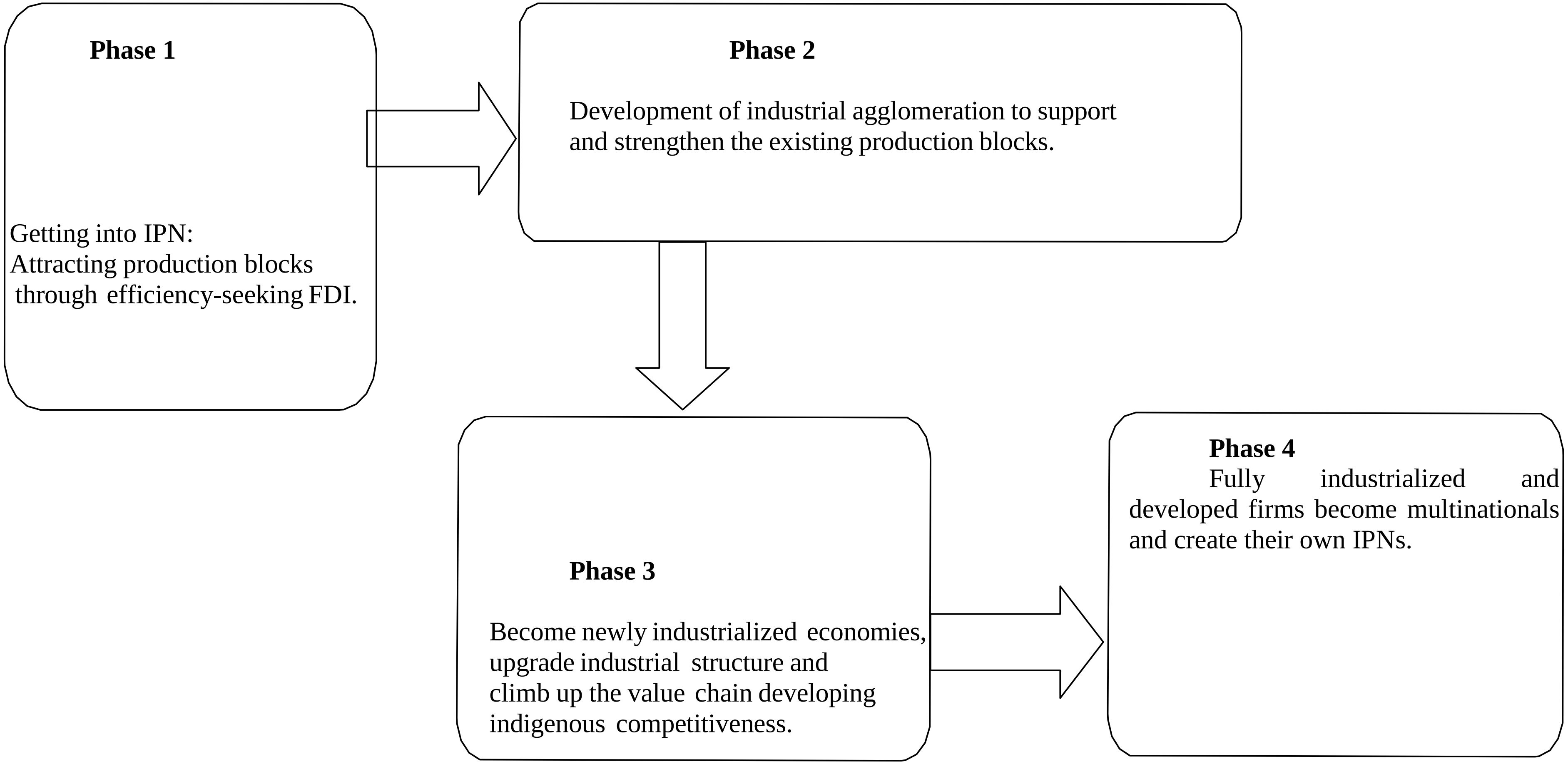
[35] *Ibid*.

		(S2)	and trade cost reductions (S3)
China	-7.27	-6.66	100.57
Hong Kong	-1.03	-0.53	17.15
India	43.27	429.63	6280.06
Japan	57.42	25.75	60.7
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

Source: Authors calculations in GTAP based on policy simulations[36]

[36] *Ibid.*

Figure 1. The Four phases of industrial development through utilizing IPNs



Source: Kimura (2009)